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SUPPLY HANDBOOK

FOR THE

ARMY SERVICE CORPS

MILITARY BOOKS.

Published by Authority.

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FOR

THE ARMY SERVICE CORPS.

Compiled under Directions from the Quarter-Master-General,

BY

LIEUT.-COLONEL J. A. BOYD, A.S.C.

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Section I.

LIVE CATTLE, SHEEP, AND DEAD MEAT.

LIVE CATTLE AND SHEEP, INSPECTION OF.

Cattle. 1st. See that the animals are of the sex and age required by contract, *i.e.*, oxen, between 2 and 8 years old; cows and heifers, between 2 and 4 years old.

2nd. See that they are well fed and in every respect of unexceptionable condition.

Each animal must be examined separately as to age and condition.

Sheep. 1st. See that they are of the proper sex and age, *i.e.*, wethers and ewes, not more than 5 years old.

2nd. See that the sheep are well fed and in every respect of unexceptionable condition. Sheep with broken teeth must not be accepted, nor those whose carcases weigh over 80 lbs., unless the contractor consent to remove surplus fat.

In examining sheep it will generally be found sufficient, if the flock appears level, to examine a few animals selected at random.

AGE OF CATTLE AND SHEEP.

This can be ascertained by examining the teeth.

Cattle. The ox has 8 front or incisor teeth in the lower jaw. The 2 centre teeth are called "Pincers," the pair next to these "Middles," the next pair "Laterals," and the pair furthest back are called "Corners."

Neither cattle or sheep have any incisor teeth in the upper jaw.

The calf at 1 month old has 8 "milk" or temporary incisor teeth.

At $1\frac{1}{2}$ to 2 years the "Milk pincers" are shed and are replaced by permanent teeth.

At $2\frac{1}{2}$ to 3 years the "Milk middles" are replaced by permanent teeth.

At $3\frac{1}{2}$ to 4 years the "Milk laterals" are replaced by permanent teeth.

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At 4½ to 5 years the "Milk corners" are replaced by permanent teeth, and the animal is said to have "a full mouth."

At 6 years the "Pincers" and "Middles" are well worn.

At 7 years the "Laterals" and "Corners" are well worn.

After 8 years the teeth lose their chizel shape, and become more blunt and worn, yellower and farther apart with each succeeding year.

Sheep. The teeth of sheep follow the same rules as those of cattle, but the changes take place a year earlier.

A good rough rule is—

Cattle. Two "broad" (or permament) teeth at 2 years and 2 each succeeding year up to 5.

Sheep. Two "broad" teeth at 1 year, and 2 each succeeding year up to 4.

N.B.—It must, however, be remembered, that in the case of well bred, and well cared for animals, cattle have frequently a full mouth at 3 to 3½ years old and sheep at 3½ years old.

The age of cattle may also be roughly guessed at by the horns.

The ox makes his 1st ring on the horns at 5 years old, and one ring each succeeding year.

The heifer makes her 1st ring at 3 years old and one each succeeding year.

These rings are, however, very undefined, and are liable to be tampered with, as they can be filed off, and so form a very unreliable guide.

"SEX," OF CATTLE AND SHEEP.

"Ox" or "Bullock" is the male animal castrated when young.

"Stag" is the male animal castrated late in life.

"Bull" is the male animal uncastrated.

"Heifer" or "Maiden Heifer" is a term given to the female animal until she has had a calf.

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"Cow" is the female after she has had a Calf.
"Wether" corresponds to the ox or bullock.
"Tied Sheep" is a term given to animals imperfectly castrated by having a string tied tightly round the scrotum.
"Ram" or "Tup" corresponds to the bull.
"Maiden Ewe" corresponds to the heifer.
"Ewe" corresponds to the cow.

INDICATIONS OF HEALTH AND DISEASE.

In examining a herd of cattle the following points may be taken as indicative of good health:—

Movements brisk, eye bright, muzzle cool and moist, dung normal, neither watery nor hard, coat glossy.

The animals should when quiet be constantly "chewing the cud;" if lying down, should when quietly raised, stretch themselves.

The following points indicate ill-health:—

Movements dull and sluggish, eye dull, muzzle hot and dry, heat at base of horns, staring coat.

Should an animal not stretch himself on being quietly raised, or not chew the cud for a length of time, or stand apart from his fellows, or cower behind a bush or wall, he must be looked upon with suspicion.

It is for the veterinary surgeon to say from what disease the animal is suffering, and whether it is in consequence unfit for human food; it is sufficient for our purposes to know that the animal is in ill-health and to reject him in consequence.

When, however, as in time of war, it is a case of eating either diseased meat or none at all, medical authorities state that animals suffering from all inflammatory and contagious diseases, with the exception of small-pox and splenic apoplexy in sheep, may be eaten without bad effects provided the following precautions are taken:—

1st. The animals to be bled as thoroughly as possible
2nd. The meat to be cooked thoroughly.
3rd. None of the internal organs to be eaten.

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Animals with small-pox, cysticerci (common in hot countries), and trichinæ should not be used.

The following symptoms are indicative of some of the common diseases to which cattle and sheep are liable:—

CATTLE.

1. *Lung disease* is marked by hurried or laboured respiration, protrusion of the nose, turning out of the elbows, and in some cases bulging or rounding of the ribs.

2. *Foot and mouth disease* is characterised by lameness and the formation of blisters at the junction of the hair with the hoofs usually at the point where the two claws or digits join; either in front or behind. By slavering at the mouth, inability to gather, or to chew the food, blisters on the upper surface of the tongue, on the pad, and on other parts of the mouth.

3. *Abdominal pain* is indicated by the animal constantly looking round at its flanks.

4. *Dropsy* is indicated by a watery swelling under the jaw or in the dew-lap.

5. *Consumption* (*Tuberculosis*) is indicated by the swelling of the glands of the throat.

6. *Liver disease* is marked by yellowness of the skin, best seen in parts devoid of hair, or where the hair is thin.

SHEEP.

7. *Rot* is indicated in the earlier stages by yellowness of the mucous membrane or lining of the eyelids. In the later stages by a pale, bluish and watery condition of the membrane; by diarrhœa, by dropsy under the jaw, by emaciation, by dropsy under the belly, and by looseness of the wool.

Looseness of the wool, and absence of the fatty secretion on the skin, are always valuable symptoms of disease in sheep, as are also, dropping of the ears, arching of the back, and drawing the legs together under the body.

CONDITION OF CATTLE.

The condition of cattle may be judged by the "quality" and "handling" points.

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QUALITY POINTS.

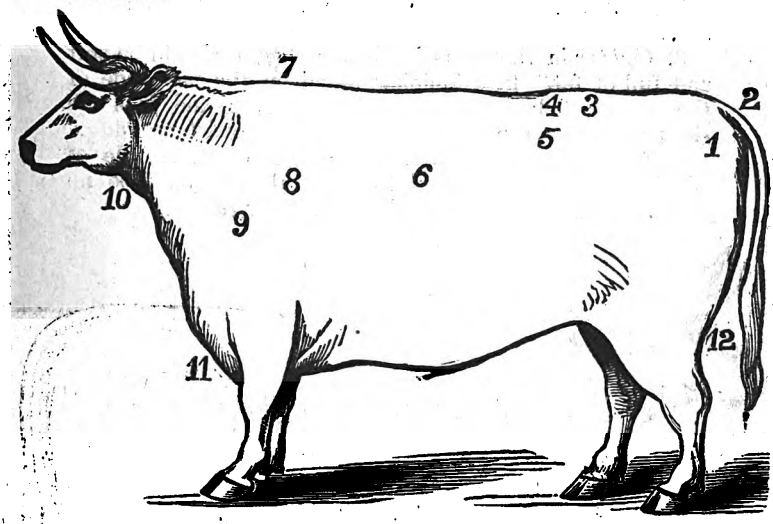
1. *Natches.*—Should be well covered and not too prominent.

2. *Tail.*—Should be broad and fat and should fill up the space between the "natches."

3. *Hips*—Should be wide. If a stick be laid from hip to natch there should not be much daylight.

4. *Loin.*—Should be wide and flat.

5. *Space.*—Generally recommended to be short, but it must be remembered that this is the most valuable part of the carcase and if the loin be good the length does not much matter.



QUALITY POINTS OF THE OX.

6. *Ribs.*—Should be well arched out from the back, so as to give the animal as cylindrical a form as possible.

7. *Crop.*—Should be broad and flat on the top and well filled up, the width of back and roundness of rib should be maintained forward so as to leave no hollow behind the shoulders.

8. *Shoulder.*—Should have a roll of fat from the upper to the lower part.

9. *Neck vein.*—Should form a collar of fat connecting the fat of the shoulder with the fat of the breast.

10. *Jowl.*—Should be filled up with a pad of fat, not hollow as in the horse.

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11. *Breast.*—Should be full, wide and deep. It should come prominently out between the fore-legs, and the dew-lap should hang to within 2 or 3 inches of the knee-joint.

12. *Buttock.*—Should have great fullness inside and out so as to give a full "twist."

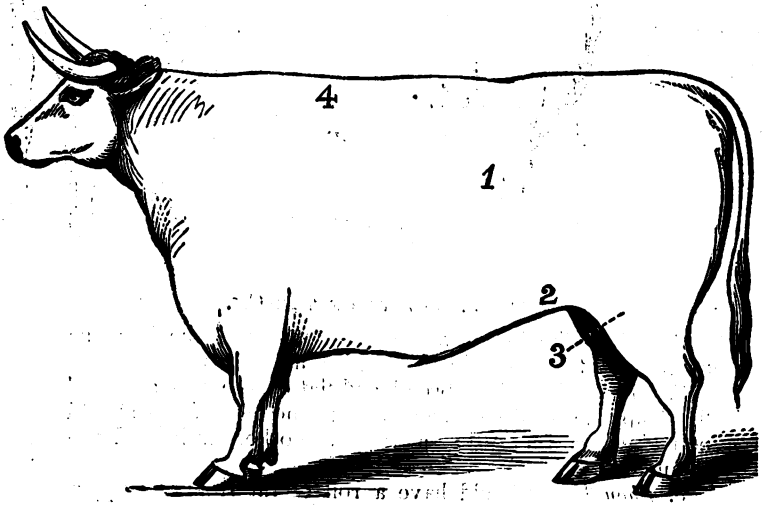
HANDLING POINTS.

1. *Rib.*—On putting the thumb and finger on either side of the 13th rib and drawing them together the skin should feel thick and pliant, and the fat between the skin and the rib should be easily felt.

2. *Flank.*—Should feel heavy and full. In a poor animal little more than the double of the skin would be felt.

3. *Cod* (or in the case of a heifer *Dug*).—Should be soft and full of fat. In examining stand on the near side of the animal, hold the tail in the left hand and pass the right hand between the hind legs to the "cod" or "dug."

4. *Crop.*—Place the finger and thumb on each side of the back-bone, just behind the crop, there should be no hollowness and the fat should be distinctly felt.



HANDLING POINTS OF THE OX.

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CONDITION OF SHEEP.

The condition of sheep is determined by the following points:—

1. Breadth of loin and rotundity of frame.
2. Straightness of back and a channel between the shoulders and along the back.
3. The buttocks and shoulders should be covered with fat.

CARE OF CATTLE AND SHEEP ON THE MARCH.

The ordinary ration for bullocks is—

Land.—3 lbs. grain, 14 lbs. dry fodder, $\frac{1}{8}$ oz. salt.

Sea. — $1\frac{1}{2}$,, ,, 12 ,, ,, $\frac{1}{8}$,,

3 lbs. of grass is equivalent in nutriment to 1 lb. of dry fodder.

Animals should be deprived of food for 12 hours before being slaughtered.

The animals to be slaughtered should be selected in the morning, and not allowed to feed during the day.

The remainder should be fed and watered early, again in the middle of the day, and again on reaching camp.

PICKETING.

Cattle should be tied, with head ropes round the horns, to trees or wagon wheels.

Sheep, as a rule, are only issued to troops when stationary, owing to the difficulty of herding and driving on the march.

Sheep pens can be made by enclosing a space of the size required with nets, stretched on stakes, with stakes placed within a few inches of each other and interlaced with brushwood, or with "bavins" placed on end in a trench, the earth being well rammed down to keep them firm. In either case a space must be left for a door, which can be closed with boards, &c

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CARCASE WEIGHT OF CATTLE AND SHEEP.

Oxen in good condition should yield not less than 600 lbs. of dead meat fit for issue. Some very fat beasts will yield as much as 1,200 lbs. Cows and heifers should yield from 400 to 600 lbs. Sheep should yield from 50 lbs. to 80 lbs.

There are 4 ways of estimating the carcase weight of cattle—

1. Pass the animals over a weigh-bridge to ascertain live weight, and allow 57 per cent. for dead meat.

2. Ascertain the length of the animal from the hollow on crop (usually well marked by a curl in the hair) to the "natches," in feet and inches. Ascertain the girth close behind the shoulder, also in feet and inches.

Then $\frac{\text{length (in feet)} \times 10 \times \text{girth}^2 \text{ (in feet)}}{3} = \text{weight}$ in lbs.

In very fat animals add $\frac{1}{20}$, in very thin ones deduct $\frac{1}{20}$.

3. Ascertain length and girth as above.

Then girth^2 × length × ·24 = weight in stones of 14lbs.

4. *By Ewart's Cattle Gauge.*—By means of this instrument a very accurate estimate as to carcase weight may be formed.

First judge what class the animal should be put in.

Large English Animals in Class I, Medium-sized and Foreign Animals in Class II, Small Cattle in Class III. Handle the animal to ascertain what heading he comes under, whether "Extra fat," "Very fat," "Prime fat," "Moderately fat," "Half fat," &c. On the back of the gauge will be found the letter answering to the animal's class and condition. Ascertain length and girth as before described. Then slide the "class" letter on the small ivory scale to the animal's length on the wooden scale below. Next move the metal slide to the animal's girth on the ivory scale, and read off the weight in scores on the top line. This weight multiplied by 20 will give the weight in lbs.

To estimate the carcase weight of sheep kill a few animals, and take the average weight of the carcases as the average weight of the whole.

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SLAUGHTERING AND DRESSING OF CATTLE AND SHEEP.

TABULAR STATEMENT showing the Trade Qualifications required for the several grades of "Butchers."

No.	Description of Work.	3rd Hand.	2nd Hand.	1st Hand.	Foreman.	Master
1	Skinning and legging sheep	Fair	Thorough	Thorough	Thorough	Thorough knowledge.
2	,, and taking bullocks heads ...	,,	,,	,,	,,	
3	,, briskets...	,,	,,	,,	,,	
4	Dressing sheep	...	Good ...	,,	,,	
5	Legging and siding bullocks	...	,, ...	,,	,,	
6	Taking bones	...	,, ...	,,	,,	
7	Killing and dressing cattle and sheep ...	...	... ...	,,	,,	
8	Chopping down	...	... ...	Good ...	,,	
9	Cutting up and preparing meat for issue	...	... ...	,, ...	,,	
10	Judging live cattle and sheep	...	... ...	... ...	Good ...	
11	,, dead meat	...	... ...	... ...	,, ...	
12	Butchery accounts	...	... ...	... ...	... ...	Fair.
13	Conditions of contract	...	... ...	... ...	... ...	Good.
14	Supervising and instructing	...	... ...	... ...	... ...	Well.
15	Erecting and working field abattoirs ...	...	... ...	... ...	... ...	,,

A squad of butchers consists of six men, viz., 1 "Foreman," 1 "First hand," 2 "Second hands," and 2 "Third hands."

For killing and dressing cattle, they are divided into two sub-divisions—

(*a*) { Foreman. 2nd Hand. 3rd Hand. } (*b*) { 1st Hand. 2nd Hand. 3rd Hand. }

The squad should kill and dress two bullocks in 45 minutes.

For killing and dressing sheep, they are divided as follows:—

(*a*) { Foreman. 3rd Hand. } (*b*) { 1st Hand. 3rd Hand. } (*c*) { 2nd Hand. 2nd Hand }

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The squad should kill and dress three sheep in 12 minutes.

Thus in a day of 8 working hours a squad of butchers will kill and dress 20 bullocks, or 120 sheep.

Roughly one butcher is required for every 1,000 troops.

The operations in slaughtering and dressing cattle are as follows:—

1. *Knocking-down.*—This is done either with the pole-axe or the mask and mallet, or in the field when cattle are wild by shooting.

2. *Pithing.*—A cane is forced through the orifice, made by the pole-axe or mask-pin, into the brain and down the spinal cord which runs through the centre of the dorsal vertebræ. This destroys all muscular action.

3. *Bleeding.*—The jugular veins are then cut through and the animal is thoroughly bled.

4. *Scalping.*—The skin is removed from the head, and the horns are chopped off.

5. *Skinning the brisket.*—The bullock is placed on his back and pritched up. The brisket is skinned and the legs jointed off at the knees and hocks.

6. *Legging and siding in.*—The skin is now removed from the hind quarters, legs and sides.

7. *Removing caul and tail.*—The urethra is removed as far as possible, the cod fat or dug evenly divided, the belly cut through till the aitch bone is reached. The caul is removed, the brisket sawn through, and the aitch bone divided, the "tree" is placed in the hamstrings and the carcase is wound up the gallows. The tail is then removed.

8. *Removing offal and hide.*—The offal or intestines are next removed, the kidneys being left in, and the hide is taken off the back. The brisket is opened and the gullet, wind-pipe, heart and lungs are removed.

9. *Chopping down.*—The sacrum is then sawn through, and the back-bone chopped through, the spinal processes being cut out with a knife and left alternately on either side of the carcase. The veins of the shoulder are then trimmed out and the neck trimmed and wiped. The carcase is fit to issue in 24 hours.

The operations in slaughtering and dressing sheep, are as follows:—

1. *Sticking.*—The sheep is thrown on its left side, and a knife is passed through the neck behind the wind pipe.

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This severs the jugular veins; the neck is then broken by placing the right hand on the nape of the neck and giving the head a sharp jerk backwards with the left hand. The sheep is then left to bleed.

2. *Legging.*—The sheep is then placed on its back, and the skin removed from the shoulders and hind legs; the gullet is tied in a knot and the legs jointed off at the knees and hocks

3. *Dressing.*—The "gamble" is placed in the hamstrings, the sheep hung up, the tail gut drawn and the skin removed.

4. *Removing offal and pluck.*—The offal or intestines is removed, the breast sawn through and the pluck removed.

5. *Wiping out.*—The "bellyset" is then placed in position, the carcase wiped and the neck trimmed.

The carcase is fit to issue after 24 hours.

Carcases of cattle and sheep should not be allowed to lie on the ground longer than necessary. The sooner they are hung up the better they will be drained.

In the field, sheep may be dressed on wagon wheels, or on a pole between two wagons.

A good gallows for dressing bullocks in the field may be made by placing a stout pole between two trees in the forks of the branches. If there are no trees, a single gyn can be made with three poles about 15 feet long lashed together at the top, or a double gyn may be made and a pole placed across the tops of two small single gyns.

In lashing a gyn the proper method is as follows:—

Place two of the poles with their small ends on a log of wood, place the third pole in the opposite direction with its small end between the other two. Place stones between the ends of the poles so as to keep them about three inches apart. Take a piece of stout rope and make a clove hitch on one of the outside poles, pass the rope over and under the three poles alternately preventing the turns from "riding" until there are six turns on the outside poles, and four on the centre pole. Then finish off with two "frapping" turns between the two outside poles and the centre one, and complete by making two half-hitches to one of the outside poles. The lashing should be about six inches from the ends of the poles. In putting up the gyns, holes should be made for the butts to rest in to avoid danger of slipping. Should poles not be obtainable, railway metals may be used but the lashing should be of chain to prevent cutting.

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DEAD MEAT, INSPECTION OF.

First see that the meat is in accordance with the terms of the contract, that is, "sound and wholesome," of the proper age and sex and well fed.

N.B.—Never pronounce on a carcase until it has thoroughly "firmed" or set.

INDICATIONS OF DISEASE IN MEAT.

First carefully examine the cavity of the chest to see if there is any adhesion of the "pleura" (covering of the lung) to the membrane lining the cavity of the chest. Should evidences of adhesion be present it shows there has been inflammation of the pleura, and if "grape" or warty-like growths of a greyish or yellowish colour are found in the lining of the chest or abdomen, or on the covering of the lungs, bowels, stomachs, liver, etc., it indicates consumption (tuberculosis). If there has been adhesion, the lining of the cavity of the chest is frequently stripped from the ribs. This can be easily detected. Look carefully under the "skirt" when the track of the knife will be seen.

Stripping is sometimes done to remove the unsightly appearance caused by "over-sticking." If the whole of the "skirt" has been removed in addition to the operation of "stripping," we may rest assured that it has been done with the object of concealing disease. Should there be adhesion of the peritoneum (lining of the cavity of the stomach) it indicates the pre-existence of inflammation of the membrane from some cause. If there has been inflammation of the peritoneum covering the liver, the adhesion is found at the anterior part of the abdomen, against the skirt and on the right side. Should the peritoneum be discoloured it indicates either mortification, commencing decomposition, or the escape of material from the stomachs or bowels. In either of these cases the colour is green. Should the colour be yellow it is due to the escape of bile from the gall bladder, if red it indicates inflammation, or blood-staining.

If on probing behind the second or "chuck" rib, or behind the pelvic or aitch bone, a foul odour is detected, it indicates mortification, putrifaction, or escape of matter in

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a state of decomposition from the stomachs or bowels. A urinous odour is due to escape of urine from the kidneys, the tubes which carry the urine to the bladder, or the bladder itself; as the result of rupture, or perforation by ulcers or worms. Should the animal have been dosed prior to slaughter, with any volatile medicine, the odour may be detected in the carcase.

If animals have been over driven before being slaughtered, the carcase will frequently have a fiery red appearance, and the flesh be soft and moist, and it may even have a parboiled appearance. These conditions are also seen when an animal has been choked. "Ship fever" which is caused by the animal being knocked about in rough weather during a voyage, is indicated by the gamboge colour of the outside of the carcase, and discoloration throughout the fat. The spleen also is generally much enlarged. A yellow tinge in the fat and tissues, is however, in many animals natural, and may be due to the nature of the animal's food, or may be sometimes traced to certain breeds.

In mutton, pallor of the "bark" or "vel" and body generally, may be due to numerous causes as to chronic disease of important organs and to want of blood (anæmia).

It is also seen in the last stages of "rot." Rot is also indicated by the whiteness of the shank bone when cut off at the knee joint. If the liver of sheep suffering from rot be inspected, "flukes" will be found in the gall or biliary ducts. These ducts have usually a white or yellowish white appearance, and the liver may be hard and pale in colour, or it may be dark brown or bluish, or it may be soft and pale in colour.

If sheep have suffered from inflammation of the lungs, the flesh is usually dark coloured, and soapy in the advanced stages. In the last stages it becomes sodden and flabby. A fiery red appearance in the external parts of the carcase of sheep indicates that the animal has been cast, and trampled on. If the redness is deep seated it indicates blood disease, or may be the result of very severe injury.

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BEEF.

Quality.

In a healthy carcase of well-fed beef, the "bark" or "vel" should be of a good dark red colour. The fat should be of a light straw colour and should be interspersed with the meat so as to give a mottled or marbled appearance. The meat should be of a bright cherry red colour and should feel fine in the grain and full of juice. Tenderness of meat depends more on the quality of the meat than on the length of time which it has been kept. Should the fat be yellow it indicates grossness, and there will be greater loss in cooking. As there is always a loss of from 20 to 35 per cent. in cooking, and the percentage of bone allowed is 20, it follows that out of the $\frac{3}{4}$ lb. ration issued to the soldier, he does not get much more than six ounces of eatable meat.

Loss in cooking.

INDICATIONS OF AGE AND YOUTH.

Age.

Age is indicated by the whiteness of the rib-bones, by the whiteness and brittleness of the vertebræ of the back, by the whiteness of the shankbones, where cut off at knee, and by the appearance of the "aitch" or pelvic bone, which in old animals has to be sawn through and is white and brittle.

Youth.

Youth is indicated by the pinkness of the rib-bones, by the deep red colour and porosity of the vertebræ of the back, by the bluish colour of the shank-bones where cut off at knee, and by the appearance of the pelvic bone, which in the young animal is divided with a knife and presents a bluish shiny appearance.

INDICATIONS OF SEX.

Ox.

The grain of ox-meat is firm and the meat feels full of juice, the carcase has an even rounded appearance, there is in the forequarter no swelling in the crest as is the case in the carcase of a bull, and no hollowness or falling away as in that of a cow. The root of the pizzle is much smaller in the ox than in the bull, and the muscle situated behind it is only $\frac{3}{4}$ inch or 1 inch wide. There is always in the ox a mass of fat on either flank, its shape being regulated by the method of castration which has been employed.

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In the bull, the textures of the brisket are much coarser, harder, and darker in colour than in the ox or cow. The contour of the arm muscles is more perfect, and they are better developed. The root of the pizzle is much thicker than in the ox. In some cases the pizzle is removed, but the retractor muscles, which by the uninitiated may be readily mistaken for it, and which are smaller, are not removed. Bull.

The muscle situated behind the root of the pizzle is much wider than in the ox, being 2 to 3 inches wide.

There is great muscular development of the whole carcase, as compared with that of the ox, particularly as regards the "crest" and the hind leg.

The "aitch" bone is very large and coarse. The peritoneum is dark coloured, and there is a general coarse condition of the carcase, both inside and out, as compared with the ox. The meat is dark in colour, and coarse in the grain, and is not juicy like ox-beef. There is a general absence of that marbling or mottled appearance of the meat which is seen in heifer or ox beef.

The characteristics of stag meat are similar to bull meat, but are less marked. Stag.

A carcase of old cow is easily distinguished by the brown spongy appearance of the udder which should be left on. It is usual to cut off a portion, leaving about ¾lb. If the udder has been left intact, and any doubt exists, cut through the udder when the brown spongy appearance will be seen. The masses of fat in the flanks of the cow when the udder has been removed are always irregular and much smaller than in the flanks of the bull or ox. Cow.

The pelvic cavity will be found much wider in the cow than in the heifer. There is a hollowness about the fore-quarter, very different to the rounded appearance of the ox, and there is also a falling away at the point of the brisket. The meat is darker in colour, coarser in the grain, and less juicy than ox or heifer beef. Of course, the indications of age already mentioned must be taken into consideration. There is also a marked change in the shape of the pelvic bone which takes place as the cow gets older. In a cow that has had many calves, little red veins will be seen where the womb has hung.

Should a doubt exist as to a forequarter, it is tolerably safe to reject it if it does not weigh 100lbs., as a forequarter of old cow seldom weighs so much.

N.B.—This rule does not apply to very small breeds of cattle such as Kerries.

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Heifer.

In the heifer the udder is but slightly developed, it is in fact enveloped in fatty tissue, and forms an uniform thick wall on either side of the flank. It is firm to the touch, whereas the udder of an old cow feels flabby and soft. There is a level appearance of the carcase generally, very different from the angular condition of the old cow. All the before-mentioned indications of youth will be noticed, and the meat will be of a good cherry red colour, marbled with fat, fine in the grain, and full of juice.

REFRIGERATED AND FROZEN BEEF.

Refrigerated beef.

Refrigerated beef comes from the United States, and is of very superior quality.

Immediately after slaughter and dressing, the animal heat is extracted, and the meat is kept at a temperature of from 36° to 40° Fahrenheit till brought to the English market.

It may be easily known by being much colder to the touch than home-killed beef, and by the discolouration of the fat, caused by the fat absorbing a certain portion of the juice of the meat. The shanks also have a more or less sanguineous appearance, caused by the method of slaughter employed; the carcases are not so carefully butchered and trimmed as is the case with home-killed meat, and the root of the pizzle (in the case of oxen) is always trimmed out.

Sometimes in home-killed beef a discolouration of fat may be noticed if the meat has been cut some time, but if a fresh cut be made it will be found that the discolouration does not extend far into the meat.

N.B.—It would be advisable for the service that refrigerated beef should be taken minus the brisket, and flank, as the latter folds and contains a certain amount of moisture, and is apt to become muggy. Also in these portions there is a large proportion of fat and bone. It would likewise be advisable only to take refrigerated meat from October to April, as it is much affected by the weather.

Refrigerated meat is much superior to frozen meat. Should the carcase have a "fusty" smell, owing to damp muggy weather, wash over with warm water and salt which will completely remove the smell.

Frozen beef.

Frozen beef comes from Australia and New Zealand. It is very hard, and takes 20 to 30 hours to thaw according to the weather. When thawed it turns a very dark colour, and a great deal of the juice escapes from the meat during the

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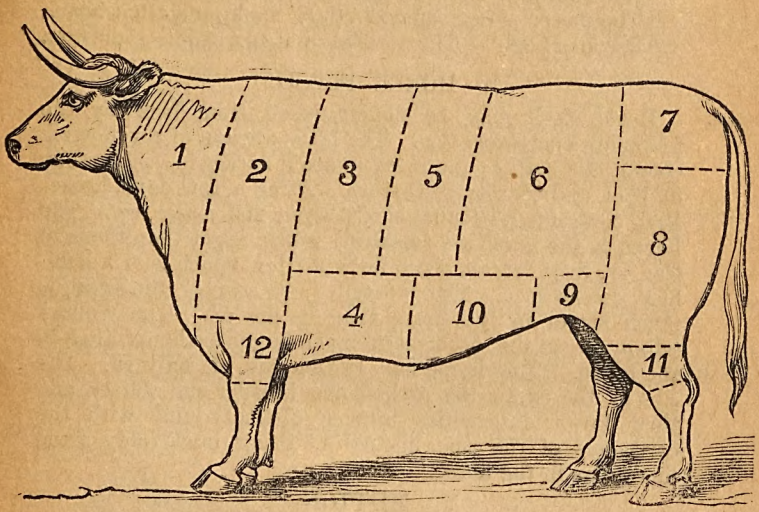
process of thawing. The outside may be tainted before the centre is properly thawed.

It is fairly good when eaten hot, but has a suety taste when cold. It is generally too fat to be serviceable for issue to troops, and is excluded from contract.



JOINTS OF BEEF.

Joints of beef.

1. Clod and sticking piece.
2. Chuck and leg of mutton piece.
3. Middle rib.
4. Brisket.
5. Fore rib.
6. Rump and loin.
7. Aitch bone.
8. Buttock.
9. Thick flank.
10. Thin flank.
11. Leg or shank.
12. Shin.

The contract states that 4 inches off the "tibia" and "radius" respectively are to be removed.

N.B.—The "tibia" is the bone above the hock joint, the "radius" is the bone above the knee joint. If the hock joint is left on for convenience of hanging in the meat store, an allowance of 1 lb. is made to the troops for each hock.

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TRADE NAMES FOR JOINTS.

Trade names.

"Horse's head."—Chuck, leg of mutton piece, and middle rib.

"Long crop."—Fore rib, middle rib, chuck, and leg of mutton piece.

"Short crop."—Fore rib and middle rib.

"Top piece."—Leg, buttock, thick flank, and aitch bone.

"Baron of beef."—The parallel joint to a saddle of mutton.

HORSE FLESH.

Horse flesh.

Horse flesh may be distinguished from beef by the following characteristics. The fat is always of a yellowish colour, and softer; the meat is much darker in colour than ox beef and coarser in texture. After a few days, horse-flesh contracts a peculiar sickly odour and soapy feel. The bones of the horse are relatively much larger than those of the ox, they contain more fatty matter, which is of a semi-fluid consistence. The "patella" (or cap of the stifle) is much larger in the horse than in the ox. The "ulna" (elbow) is on the other hand much larger in the ox than in the horse. The horse has 18 ribs, the ox only 13. The ribs of the ox are less arched, are broader and flatter, and their lower extremities form a distinct joint with the cartilages of the ribs, instead of being immovably fixed thereto as in the horse.

MUTTON.

Quality of mutton.

A healthy carcase of well-fed mutton will be of a purplish red on the "bark." It should be "mackerel backed," that is, there should be alternate bars of red and white over the loins.

In a young animal the ribs and knee joints will be pink. The points indicating disease before described should be noted. A carcase of mutton will not be too fat if the blue of the lean can be seen through the fat on the wither.

"Wether."

In a carcase of wether mutton the pizzle (which should be left in) should be very thin—not thicker than an ordinary lead pencil. That of a tup or ram is twice that size. The neck is not so thick as in the ram, and the bark is a bright red colour.

Ewe mutton.

In the ewe the udder is soft and spongy, and holes will be seen where the nippies have been. The neck is longer and thinner than in wethers. If the ewe has had many lambs, small veins will be seen where the womb has hung, and the pelvic cavity becomes larger with age. The

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knuckle bones are smaller in ewes than wethers. As the animal becomes older the knuckle bones turn white. Should the udder have been cut away, and a doubt exist as to whether the carcase is ewe or ram, cut through the pelvic bone, when, if ram, the root of the pizzle will be seen. In old ewes the bark is of a pale drab colour, and age will be indicated by the whiteness of the knuckle bones and ribs.

Maiden ewes.

In the carcases of maiden ewes, the dug is firm and hard, and the bark bright coloured. Youth will be indicated by the pinkness of the ribs and knuckle bones, and there will be no veins where the womb has hung.

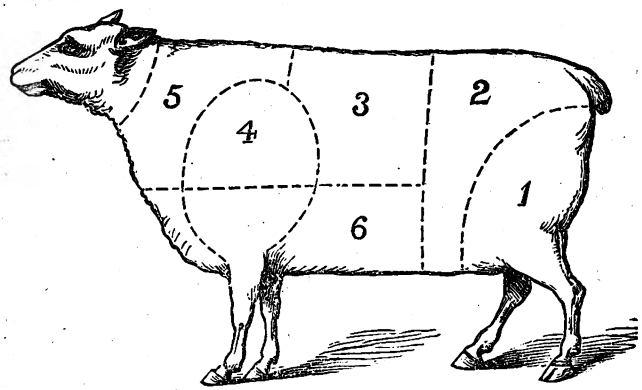
In the ram or "tup" the pizzle is very much thicker than in the wether, the neck also is thicker, and the muscular development is greater, particularly noticeable in the forearm.

Tied sheep.

Tied sheep usually come from Holland. It is a name given to sheep castrated by having a string tied tightly round the scrotum, which is then allowed to slough off. They are generally ill-fed and the pizzle is not nearly so thin as in the clean cut wether. So little are they removed from the ram, that they should be rejected.

Frozen mutton.

Frozen mutton comes from Australia and New Zealand. It is very hard and rings like iron when struck, and takes about 24 hours to thaw. The pelvic bone should be divided to see if any decomposition has taken place near the bone.



JOINTS OF MUTTON.

1. Leg. 2. Loin. 3. Neck (best end).
4. Shoulder. 5. Neck (scrag end). 6. Breast.

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The "leg" and "loin" together are called a "haunch." The two loins together are called a "saddle."

The legs are cut off at the knee and hock joints.

Goat. Goat flesh may be distinguished from mutton by being much darker in colour, and less abundant, but there may be equally as much fat in the loins of the former as in the latter. When newly dressed, the flesh of goat gives off a distinct "goaty" odour.

ISSUE OF MEAT TO TROOPS.

Dryage. Meat loses a certain proportion of weight by drying after hanging. The average loss in this country is as follows:—

Loss in 24 hours 1·23 per cent.
" 48 " 2·02 "
" 72 " 2·46 "

Contract states that the weight of the meat is to be taken after it has hung for a period not exceeding 48 hours.

Wasteage. In order to cover waste in cutting up, the troops receive an allowance of 1 per cent., which is calculated as follows:

From 1 to 50 lbs., nil. From 150¼ to 250 lbs., 2 lbs.
" 50¼ to 150 lbs., 1 lb. " 250¼ to 350 lbs., 3 lbs.
(And so on.)

Hind and fore quarters (and where necessary smaller joints) are issued in rotation to each regiment or detachment. The master butcher keeps a book for recording the joints issued to each regiment, &c., in order that a fair division of the carcases may be made to the troops.

PRESERVED AND SALT MEAT.

Tinned meat. Tinned meat is preferable to salt meat, as it is more portable, does not induce thirst, is more palatable, being already cooked there is no loss in cooking, and there is no bone.

Inspection of tins. Tins of preserved meat, soup, etc., will be considered as unfit to be received from contractors, for any of the following reasons:—

1. When perforated by nails, &c.

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2. When there are any angular indentations, which are likely to have caused partial fracture to the tin, and rendered it liable to rust.

3. When they contain deleterious gas, or are bulged or blown.

4. When they are rusty.

5. When it is found that the tin does not adhere closely to the contents, or when it is evident that the tin has not been hermetically soldered, and that the meat has either dried or putrefied in consequence.

After each tin has been subjected to such inspection, as would preclude the possibility of any of the above damages existing, the whole will then be placed in rows, and the examiner will strike each tin lightly with a small wooden mallet or lead pencil, and put aside for the decision of the officer in charge, any tins which by their hollow sound appears to contain meat in an incipient state of putrefaction, fermentation, or not to have been filled to their capacity. If the former be the case it will be found that gas has generated, and if the latter that the tin feels "hard" all over its surface.

Recips for salting meat.

The following formula show the ingredients required for salting 14 lbs. of beef or mutton:—

Common salt	1½ lbs.	}	or	Common salt	1 lb.
Saltpetre ..	½ oz.			Sugar ..	½ "
				Saltpetre ..	½ oz

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Section II.

BREAD STUFFS.

Military bakeries are divided into two classes—

a. Garrison bakeries.
b. Field bakeries.

Garrison bakeries are established with the object of training men of the Army Service Corps during peace time for the duties of field service. Military bakers should be thoroughly trained in making bread in the field, and therefore field bakeries should be established in the vicinity of the permanent bakeries and a portion of the bread should be baked therein. The men should be trained to make bread with the implements that would be provided on field service.

Orders for the Master Baker.

The bakers detailed for work will be under his orders and will work in such sections and during such hours as may be required. He will superintend the work day and night, and will be present at the preparation of all ferments, sponges, &c.

He will keep account of all materials, and will see that in the manufacture of flour into bread the correct result is brought to account.

On the receipt of all materials he will see that they are of proper weight and quality, and will notify to the officer in charge any breach of contract.

He will prevent waste in "shooting" flour into the troughs. He will hand over personally to the contractor all damaged bread, sweepings, and brew-house refuse, and record the quantities in the book kept for the purpose, obtaining the contractor's receipt for the same.

Should the workmen through neglect spoil bread or yeast he will at once bring it to notice in order that those concerned may be punished.

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He is responsible for the good management of the bakery in brewing ferments, sponging, dough making, heating ovens, &c.

Fancy bread making by the bakers is prohibited. No material in his charge to be used for other than public services. No visitors to be admitted without permission. He is responsible for all implements, glass, &c., in the bakery, and will hand the same over to the non-commissioned officers in charge of the day and night sections on their arrival, and receive over from them on their departure. Any damage or loss will be at once reported against the individual, or, if not traceable, against the section concerned. Any damage or deficiency ascertained at quarterly or other inspections must be charged against the master baker.

He will inspect the implements weekly to see that they are kept clean and in good order.

Classification of Bakers.

This is regulated according to the manner in which they perform their duties.

The following is a statement showing the qualifications required for the several grades :—

No.	Technical descripton of Work.	3rd Hand.	2nd Hand.	1st Hand.	Foreman.	Master.
1	Dough-making	Fair.	Good.	V. Good.	V. Good.	Thorough knowledge.
2	Moulding...	,,	,,	,,	,,	
3	Setting sponges	,,	,,	,,	,,	
4	Scaling dough	...	,,	,,	,,	
5	Setting dough	...	...	,,	,,	
6	Drawing bread	...	...	,,	,,	
7	Judging temperature of ovens	...	...	Good.	,,	
8	Baking	...	...	,,	,,	
9	Brewing	...	...	...	Good.	
10	Stirring ferments ...	...	...	...	,,	
11	Judging flour, &c. ...	...	...	...	...	Well.
12	Rough accounts of receipts and issues, and of bread produced ...	...	...	...	...	To be kept clearly.
	Field Ovens.					
1	Pitching and striking ...	...	...	...	Good.	Capable of instructing squads in.
2	Working	...	...	...	Good and capable of directing a small party.	

The classification serves to fix the rate of corps pay and enables the men to be so told off as to perform their work without delay, each man having a particular duty to perform

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Bread Storekeeper.

A non-commissioned officer is told off to take charge of the bread. His duties are as follows :—

To receive and keep a correct record of bread produced by each foreman.

To keep the bread produced by each foreman separate with the latter's name affixed, so that any neglect can be traced to the responsible person.

To immediately inform the master baker when bread of inferior quality is being delivered into store.

To make all issues to the troops, and obtain receipts for the same.

No issues to be made of retail bread to officers, &c., without production of pass books.

After the master baker's inspection to put on one side all damaged bread, which must be issued to the contractor in the presence of the master baker.

He is responsible for the cleanliness of the store and the inside of the bread wagons.

Bakery Accounts.

Master Baker's Account (*Army Book* 310).—All receipts including bread produced are entered on one side, and all issues including bread issued are entered on the other side. The total quantity of bread issued should agree with the receipted issue checks, of which an abstract should be made daily. At the end of the month the total issues deducted from the total receipts should give the remains agreeing with stock in hand. The Bakery Statement, Army Form F 700, is compiled from this book. As a master baker should know the amount of supplies he has on hand, a place is provided in his book to show this. The remains from previous day are here totalled up with receipts and the issues deducted, thus showing remains.

Damaged Bread, &c., Account.—Damaged, broken, or burnt bread, sweepings from bakery and stores, waste malt and potato peelings from the brew-house are sold to the contractor, and the master baker keeps an account of them and obtains the contractor's receipt in a manuscript book. In the Bakery Statement (F 700), the actual amount of damaged bread sold to contractor is entered and also "loss on damaged bread." This loss occurs in this way. A certain number of loaves are damaged and should weigh a certain amount, but being burnt or broken they do not run the proper weight, and therefore the difference between the weight actually issued to the contractor and the amount the bread should have weighed if not damaged is the "loss on damaged bread." The amount of sweepings and damaged bread are entered from this

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book into the Bakery Statement at the end of each month. A debit voucher in triplicate is made out for sweepings, damaged bread, and brew-house refuse. One copy is sent to the contractor, and two to the District Paymaster. When the original is returned by the paymaster it is attached to the Bakery Statement as a sub-voucher for striking off the quantities shown therein. Flour sweepings should not exceed $\frac{3}{4}$ lb. per. 100 lbs., and damaged bread $\frac{1}{2}$ lb. per 100 lbs. of bread. If bread is burnt or damaged in undue quantities, the foreman responsible should be required to pay for the difference between the cost price of the bread, and the amount for which it was sold to the contractor. This amount is accounted for on a debit voucher attached to the voucher for the sale of damaged bread.

The Monthly Bakery Statement (Army Form F 700) is a conversion voucher, *i.e.*, a receipt voucher for bread produced, and an issue voucher for the materials used in its manufacture. In putting it up with the account it receives one number as an issue and one as a receipt voucher. It is compiled from and should be checked with the master baker's book (Army Book 310). In crediting the bread in the magazine book only the serviceable bread should be brought on charge; "damaged bread" and "loss on damaged bread" is accounted for in Army Form 700.

To check consumption of materials :—

1. *Fuel.*—The amount of fuel used during baking hours should be ascertained, and the amount required to bake 100 lbs. of bread worked out and taken as a standard.
2. Hops, malt, sugar, and potatoes can be easily checked by the scale (see Appendix VI).
3. *Yeast Powder.*—One tin per sack of flour, but 1½ tins make better bread.
4. *Ration and Hospital Flour.*—These should be checked separately with the ration and hospital bread, by working out "gain per cent." To do this add together number of lbs. flour used, deduct sweepings; result is net total number lbs. of flour used. Deduct this amount from total lbs. of bread produced. Multiply by 100 and divide by the total lbs. of flour used to two places of decimals; result is "gain per. cent," which should be shown in Army Book 310 and Army Form F 700.
5. *Salt.*—From 9 to 15 lbs. per 1,000 lbs. flour.

The Quarterly Bakery Statement (Army Form F 701) is a statement forwarded to the War Office at the end of each quarter to show whether the bakery has been conducted in a satisfactory manner. The expenses for "superintendence," "labour," "rations for men employed," "materials," "fuel and light," "cleaning things," and "miscellaneous services" are worked out. The total amount of bread produced in the quarter is ascertained, and the average cost of each of the above items (per 100 lbs. of bread) calculated. The

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total of these gives the cost of 100 lbs. of bread, from which the cost of 1 lb. can be ascertained. The price of bread produced is about the same as that supplied by contract. In civilian bakeries bread is produced cheaper than in military ones, because fewer men are employed, and the ovens are at work from Monday morning until Saturday night, and never being allowed to cool, a great saving in fuel and time is effected.

Learners should not be taken into account in calculating cost of labour.

A Half Yearly Comparative Statement (F. 745) is sent to the War Office at the commencement of each new contract for bread and meat. It shows cost of ration of bread and meat separately, daily increase or decrease on cost of ration under new and old contract and total increase or decrease of the total cost for ensuing period of contract. To ascertain cost of a ration of bread—take cost of a sack (280 lbs.) of flour, assume this to produce 368 lbs. bread. Then a fair proportional charge of—

1. Cost of materials.
2. Wear and tear of implements.
3. Pay and Corps Pay of bakers.
4. Transport.

Add together and divide by 368 result is cost of 1 lb. bread = a ration.

Bakery Implements.

Lamp, oven.—For seeing into ovens where there is no gas.
Offsett, bakers'.—Used to prevent the bread from being burnt by contact with the hot bricks.
Peels, drawing and setting.—For placing the bread in the ovens and withdrawing it.
Pokers, bakers'.—For raking out the cinders between the pipes in the furnaces of the steam ovens.
Rakes, bakers'.—For raking out the furnaces.
Rasps, bread.—For rasping the burnt crusts of loaves that have been "topped" before issuing to the troops.
Saws, bakers', zinc, for salt.—For cutting blocks of salt. Made of zinc because the salt would corrode iron.
Scales, dough, pan.—For scaling the dough.
Troughs, dough, four-sack.—For setting the sponges and mixing the dough in. They are fitted with two partitions or "pin boards" and three lids.
Wagons, bread and meat.—Are covered wagons fitted with a series of movable shelves for packing the bread.

The Brew-house should be well ventilated and have a stove in order that an even temperature may be kept up. The floor should be stone or brick; there should be no drains or cess-pools near, and it should be kept locked when not in use.

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Brewing Utensils.

Copper cauldrons, holding 45 gallons each, with wooden covers and taps. They should be built over fire-places.
Brewer's thermometer, used for ascertaining the temperature of the brew-house and of the water in the various operations.
Potato strainer.—A tin colander for straining the potatoes in making a ferment.
Potato smasher for mashing potatoes.
Oar, for stirring the malt liquor and mixing.
Yeast tubs.
Hair sieve.
Cloths, Osnaburgh, for covering the yeast tubs.
Bowls, iron, galvanized.

In the "Field" some of the operations would be done in a field kitchen and some in a tent. Iron pails would be used instead of yeast tubs, and camp kettles instead of cauldrons.

Cleanliness of Implements.

All implements in the brew-house must be kept perfectly clean and sweet. They should always be cleaned immediately after using. Should the yeast tubs become sour, they should be filled with shavings, turned over and the shavings set fire to. This will char the inside slightly and render the tub sweet again. It should be scraped and washed with boiling water before using. No soap should be used in washing the tubs, boiling water and a brush being sufficient. New tubs should be thoroughly washed with cold water; a pint of hot brine should be well rubbed in, then emptied and a quart of fermenting yeast poured into the tub and well rubbed in. Yeast will at once go sour if placed in a dirty tub.

Orders for the Brewer.

1. He is to give constant attention to ferments, yeast, &c.
2. To see that the master baker's instructions as regards quantity of yeast to be brewed are carried out according to the proper scale of materials, and to see that the yeast longest made is used first.
3. To maintain order among the men and to see that the brew-house and implements are kept clean.
4. To adhere carefully to the "temperatures" and times laid down for the various operations in brewing.
5. On the approach of a thunder storm, to carefully cover up the tubs containing the yeast, and should the yeast suffer, to report the matter to the master baker.
6. To maintain the proper temperature of the brew-house day and night, viz., not more than 64° Fahrenheit in summer nor less than 54° F. in winter.

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7. To allow no one to drink the yeast or take away any from the brew-house, except that actually required for the manufacture of bread.

The materials used in making "yeast" are malt, hops, water, and sugar.

For making "ferments," potatoes are used.

Malt.

Malt is usually obtained by contract, but may be made as follows:—

The conditions as to materials, implements, &c., are—

1. A yeast tub for steeping the grain (barley).
2. A floor to spread it on.
3. A kiln to dry it in.

An ordinary yeast tub will do if a hole be drilled near the bottom, which should be fitted with a cork, and the inner side of the hole covered with perforated zinc.

The floor should be of stone flags and should be in a building impervious to the sun so that a uniform temperature of 60° F. may be maintained.

For a kiln, the top of an ordinary brick oven will do, or the grain may be dried in an oven at a temperature not exceeding 100° F.

More barley should not be steeped than can be dried in the kiln at one time.

Malt may be made from several kinds of grain, but barley is by far the best. Only the best barley should be used. It should have a thin, bright, clean, wrinkled husk, a plump kernel, which when broken appears white and chalky, with a full germ of a pale yellow colour. Although the barley must have seasoned in the stack to render it fit for malting, yet if over heated its vitality is destroyed. It cannot be used for four months after harvesting, and if more than one year old is useless. The grains should be of the same size so that they may grow evenly. Barley is much subject to the attack of weevil, but the damaged grains can be easily detected by throwing a handful of barley into water, when the sound grains will sink and the damaged grains will float. Malting consists of three successive operations—

1. Steeping.
2. Germinating.
3. Kiln-drying.

Steeping.—Place the winnowed barley in the yeast tub filled with clear water so that the water stands 5 inches over the barley when all the light seeds are skimmed off. The water may be renewed two or three times. Forty to forty-eight hours is the duration of the steep. The steeping expands the kernel and prepares it for germination. If a grain pressed between the finger

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and thumb continues entire in the husk, it has not been sufficiently steeped; if it squeezes out in a milky grain, it has been too much steeped and the barley is spoilt; if it sheds its flour on the fingers it is ready.

Germinating.—The water is now drawn off and the barley laid on the floor in square heaps from 12 inches to 16 inches high, and left for twenty-four hours. The barley first gets dry, then warm, and begins to sweat, at which period the germination begins. The roots sprout from the tip of each grain and grow rapidly. About a day after the appearance of the roots, the leaf (called the acrospire) begins to sprout from the same end as the root, but turns round under the husk and grows towards the other end, where it would emerge as a leaf were its growth not arrested. The greatest heat occurs about ninety-six hours after the barley has been placed on the floor, and it is now necessary to spread the barley thinner and turn it several times a day to make the germination uniform. The depth of the heaps is lowered a little at every turning till it comes to 3 or 4 inches. This growth of the leaf causes a remarkable change in the substance of the grain, converting the grain into glucose as it passes along. The grain is not completely malted till the acrospire reaches the opposite end from which it sprung. At this period the growth must be stopped, for should the leaf shoot forth the grain would be spoilt. Fourteen days is the usual time taken for the germinating process in England, but in hot climates four days are often sufficient. Sometimes in dry weather the barley must be sprinkled with water, as it becomes too dry and the seed dies. A temperature of 60° F. is best for the operation.

Kiln-drying.—The malt should be evenly spread to a depth of 3 or 4 inches, and dried at a temperature between 90° and 100° F. It should be turned over frequently at first and latterly every three or four hours. This operation should not be hurried, two days are frequently given. The malt should now be sifted, the roots, which become brittle from drying, being thus separated from the husk. The malt is put away in sacks till required for brewing, when it should be ground in a mill. It should be kept three months before using. A loss of 20 per cent. occurs in the process of malting, which is accounted for by conversion voucher.

Choice of Malt.

Good malt should be full and round, with a thin skin. It has a sweet, mellow taste and bites soft, an agreeable smell, and is full of a soft flour. It should weigh 40 to 42 lbs. per bushel. To test malt, throw a handful in water, if properly malted it will float on the surface, if not sufficiently malted it will sink or float in mid-water on end. If barley has been mixed with the malt (which is sometimes done to make it weigh heavier) the mixture can be detected

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in the same way ; the malt will float and the barley sink. Before using, the malt should be ground, but the mill should not be set too fine

Hops.

Hops are used in the manufacture of yeast. They give it an aromatic taste and counteract its natural tendency to turn sour. They are grown in several counties of England, and require great skill in cultivation. The female plant is the one used. The most valuable part of the hop flower is the farina, or yellow powder in which the seeds are embedded. The hops are dried in oast-houses, and then well rammed into sacks or "pockets" of fine canvas, which weigh about 1½ cwt. when full. They should be kept in a dry place. Each pocket is obliged by law to be marked in plain letters with the grower's name, the county and parish in which they were grown, and the gross weight of each pocket. There is a penalty of £20 for false marking or for mixing hops of different quality.

Choice of Hops.

Good hops, when rubbed between the hands, leave an oily, sticky, and resinous substance, with a strong smell. The more the palms of the hands stick when pressed together the better the quality of the hops. The yellow powder (farina) should, in good samples, amount to one-sixth of the weight. The scales should be even in colour, between green and yellow, and there should be no mould on the stem. The less stalk and green leaf the better. The newer the hops, the better the quality. The old stock should, therefore, be allowed to run out towards the end of September. The value of old hops is only one-third of new. The contract stipulates that hops should be "of this or last year's growth." Their average price is £5 per cwt.

Sugar.

Sugar is used to stock the yeast.

Water for Brewing.

River or pond water (with a stream running through it, and with a gravelly bottom) is the best. Rain water is the next best If these cannot be obtained spring or well water must be used, but it should be exposed to the sun in tubs for several days, and a little powdered chalk should be thrown in and stirred frequently.

Yeast.

Yeast is a plant belonging to the fungus tribe, which, in congenial soil, grows with wonderful rapidity, and in its growth gives

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out large quantities of carbonic acid gas. Glucose, or grape sugar, is the seed of the yeast plant, and is also the soil most suitable for it. Any substance containing glucose, therefore, will propagate the plant. Glucose may be formed by moistening with water, any substance containing starch. So if wheaten flour be made into dough and placed in a warm room, glucose will be formed, and after a time the yeast plant will grow; and in the same way it may be obtained from sugar-cane or potatoes, but the quantity is smaller, and the quality not so good as that obtained from good malt. The growth of the plant is started by steeping the malt in warm water and maintaining a certain temperature in the brew-house. A decoction of hops is added to give it an agreeable flavour and to prevent it going sour. In growing, the yeast splits up the glucose into alcohol, water, and carbonic acid gas, and it is to raise the dough by means of this gas that yeast is used.

There are six kinds of yeast employed in the manufacture of bread—

1. Patent or hop yeast.
2. German or dried yeast.
3. Brewers' yeast or barm.
4. Sour dough yeast.
5. Potato yeast } These are usually used as ferments.
6. Sugar yeast }

The fungus is the same in each.

Patent or Hop Yeast.

Patent or hop yeast is a watery liquid, containing large quantities of the yeast plant in suspension. Were this yeast boiled it would become beer, but the vitality of the yeast plant would be thereby destroyed. This yeast is always used in Army Service Corps bakeries, except sometimes on Field Service, when sour dough is used, as it is more portable and more easily made.

To 1,000 lbs. flour use 3 gallons yeast for a long sponge or 1½ gallons for a short sponge.

To make 3 gallons yeast, use—

Malt, 3 lbs.; hops, 2 ozs.; sugar, 4 ozs. The amounts given in this scale are ample, but should the malt be bad 2 ozs. more per gallon may be used.

To ascertain Number of Gallons to Brew Daily.

As three gallons of yeast are required for 1,000 os. of flour (for a long sponge), then if the average monthly consumption be 100,000 lbs. of flour, the yeast required will be 300 gallons. It is advisable to brew every day except Sundays.

If there are five Sundays in a thirty-day month, there will be

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twenty-five days, and the amount to be brewed each day is 12 gallons.

When short sponges are used, half the amount only will be required, and it will be sufficient to brew every alternate day.

Brewing.

Brewing consists of four operations—

(1) Mashing.
(2) Simmering the hops.
(3) Mixing the hop liquor with the malt liquor, and
(4) Fermenting.

To make 12 gallons of yeast—

(1*st*) *Mashing.*—Steep 12 lbs. of crushed malt in 3½ gallons soft water warmed to a maximum heat of 170° in winter and 145° in summer. Stir the mixture thoroughly with an oar. Cover with a cloth or blanket and let it stand 1½ hours. The exact temperature of the water must be left to the discretion of the brewer, but he must keep within the limits laid down, and must use a thermometer and not go by guess. If the temperature is too high, the flour of the malt will set and form a paste, and the extract will be little better than water. If the temperature be too low, the "wort" will be weak because the heat of the water was insufficient to extract the saccharine matter from the malt. When the process is complete the wort will have a sweet taste, and little but the husks of the malt will remain undissolved. Wort is new beer unfermented or sweet infusion of malt. If malt is not obtainable, wheaten flour may be used (⅓ more than the usual quantity of malt being required) but it makes a bad substitute.

(2*nd*) *Simmering the Hops.*—While the mashing is going on simmer ½ lb. of hops in 10 gallons of water in a copper cauldron. The temperature of the water should be kept at 200°. The hops should not be simmered for more than 1½ hours. If the water be allowed to boil, the decoction will be spoilt.

(3*rd*) *Mixing the Hop Liquor with the Malt Liquor.*—The hops having been sufficiently simmered, the fire should be drawn and the liquor allowed to cool to 180° in winter or 155° in summer (10° hotter than the water used in mashing). It is then strained through a linen sieve on to the malt, the leaves which are left being well squeezed between the hands. The two liquors are then well stirred together, covered with a cloth and allowed to cool for ten hours.

(4*th*) *Fermenting the Mixture.*—The liquor is next strained through a hair sieve into a clean tub, the husks of the malt remaining being well squeezed between the hands. One pound of sugar is then placed in the sieve and 2 gallons of old yeast poured over it, which, as it runs through the sieve into the liquor, dis-

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solves the sugar. The liquor is then thoroughly stirred. Old yeast is added to hasten the growth of the yeast plant. If none be obtainable, stout may be used for the same purpose but is not so good. Three to four hours after adding the old yeast, the fermentation begins. A milky froth appears on the surface, spreading from the centre to the sides and changing to a light brown colour. When the fermentation subsides the froth should be skimmed off, otherwise some of it will sink and render the yeast unpleasant and liable to be excited at every change of weather. The best fermenting temperature is from 54° to 64°. Any approach to frost will spoil the yeast. The fermenting tuns should be kept closely covered with cloths or close fitting lids. In brewing there is a loss of 10 per cent. on the quantity of water used, owing to evaporation and to a certain amount of liquor being absorbed by the husks of the malt and the hops. Good yeast should have a pleasant, sweet taste. It should be yellow and not transparent, and should have a brisk, lively appearance. Bad yeast is acid and bitter, of a dark brown colour, dull, and sometimes ropy.

German Yeast or Dried Yeast.

German yeast or dried yeast is made by mashing crushed rye with barley malt. To every 100 lbs. of grain, ½ lb. of carbonate of soda, and 6 ozs. of oil of vitriol diluted with water are added to the wort, which is fermented by the addition of old yeast. The froth is skimmed off, strained through a hair sieve into cold water and allowed to settle. It is then collected and pressed in cloth bags till it has the consistency of dough. It is imported from Germany in hempen bags containing 56 lbs. It rapidly deteriorates and should be kept in a cool place. If used with a ferment, 6 ozs. to every sack of flour is required. If by itself, 8 ozs. will be necessary, which should be dissolved in three pints of tepid water.

Brewers' Yeast or Barm.

Brewers' yeast or barm is the froth that gathers during fermentation on the surface of the beer. It should be from ale brewing as that from porter brewing is dark and heavy. Small beer yeast is weak but rapid in action. If mixed with a ferment 4 pints per sack is sufficient, if used by itself 8 pints are required. If bitter it should be strained through a hair sieve with a little bran in it.

Sour Dough Yeast.

If flour be mixed with water, it partially decomposes or ferments, and carbonic acid gas is formed. If the sour dough was originally made with a mixture of yeast the fermentation is more rapid than if made with flour and water only. Sour dough is used

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in all the French Army Bakeries and in most private bakeries on the Continent. 14 lbs. of dough to the sack of flour is required, and should be put aside to ferment till the following day. It should then be broken up and 3 gallons of water added to it. The sponge should then be set as usual, and it will take twelve to sixteen hours to rise. The dough should be taken at the first drop. It is more suited for hot than cold climates. At least once a week the sponge should be set with yeast, otherwise the fermenting power becomes weak.

Yeast is affected by thunder in the same way as milk. During a thunder-storm the yeast should be closely covered and iron rods placed over the tun and down the side, which will conduct the electricity away from the yeast. If the yeast be affected, add 1 lb. of moist sugar to every 7 gallons of yeast, which will strengthen and revive it. Two ozs. of ginger added to the brewing will, to a great extent, protect the yeast from thunder. The vitality of yeast is destroyed by mechanical injuries and extremes of temperature. German yeast is particularly susceptible to blows or falls. If injured it becomes dark in colour, soft and sticky, and stinks.

Ferment Making.

To hasten the growth of the yeast plant, a "ferment" is necessary during the winter months in cold climates. This is made of a mixture of potatoes, flour, and yeast. For every 1,000 lbs. of flour: boil and mash 18 lbs. potatoes, to which add 7½ gallons water, 1½ gallons yeast, and 1 gallon paste made from 6 lbs. flour. Mix well together and set aside to ferment. In two hours the mass will begin to rise owing to the production of carbonic acid gas. This continues for about four hours, when the fermentation ceases, and the mixture will be ready for use about two hours afterwards. Then strain through a colander and about 10 gallons ferment will result, the refuse consisting of potato peelings, which form part of the "brew-house refuse." Boiling water should not be used in making paste of the flour as it turns the starch into gum. The proper fermenting temperature is 70° in summer and 90° in winter. The heat of the potatoes will give the former temperature, while if necessary the water may be sufficiently heated to raise the temperature to 90°. Sugar may be used instead of potatoes, and should be dissolved in hot water. In this country, ferments are generally used, as the dough rises and falls twice in eight hours, whereas with yeast alone it takes twelve hours. In hot climates and on field service, ferments should not be used as they tend to make the bread go sour.

Diseases of Corn.

The grains of corn are much subject to diseases resulting from attacks of fungi. The general effect is that the centres of the grains become spongy, diseased, and unwholesome, if not poisonous.

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Sometimes the grain turns black. The chief of these fungi, which attack corn are Ergot, Burnt-ear, Smut, Rust, and Mildew.

Detection of Disease.—Blighted, diseased, ergotized, kiln-dried corn, or corn that has heated in the stack or fermented, after being damaged by salt or fresh water, contains but little gluten, which will be found to be oily, non-elastic, and with an unpleasant smell. Disease, kiln-drying or fermentation always decomposes the gluten which becomes rotten. Small black specks will be found in flour made from diseased corn.

Insects which attack Corn, Flour, &c.

The weevil is a small insect of the beetle tribe, which bores hole in the grain in which to deposit its eggs. To detect weevils throw a handful of the grain in water—the good grains will sink, whilst those attacked will float. Again, sift a sample through a wire sieve on to a sheet, when the weevils will be seen creeping on the white sheet. If corn is attacked, winnow often, and spread thinly on the floor; cover with sheets—the weevils will collect on the sheets, which should often be removed and swept. To clear granaries from weevil, mites, &c., cover the walls completely with quicklime, slaked in water in which trefoil, wormwood, and hyssop have been boiled. This should be applied as hot as possible.

Acari or mites are common in flour which is beginning to turn, especially if it is damp. The presence of mites can be detected by dissolving a small quantity of the suspected flour in water, when the insects can be seen swimming on the surface. They are so small that a magnifying glass is often necessary to see them. If the bakers are attacked with itch, the flour, &c., should be examined, as it is more often due to the presence of these insects in the supplies, than to want of cleanliness in the men.

Meal Worms.—Flour, if damp, gives birth to meal worms, which increase rapidly and destroy the substance of the flour. The only way to prevent their breeding is to obtain well-prepared flour, containing not more than 10 per cent. of water, and to prevent it getting damp. If flour becomes affected with meal worms, the only thing to do is to make into bread as quickly as possible, passing it first through a fine sieve to remove the worms. Flour should always be kept in a dry place, as nothing deteriorates so quickly from damp as flour. Before receiving a parcel of flour, a sample of 1,000 lbs. should be sifted and the siftings examined to detect meal worms, weevils, &c.

Flour.

Wheat and rye are the only grains which, when converted into flour, can be used by themselves for the manufacture of bread. Rye is not much used in this country, but on the Continent is largely used for the making of black bread. Wheat is much more suitable for

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bread-making. There are many varieties of wheat, but they may be divided into two heads—red and white, or hard and soft respectively. The former contains less water, less starch, and more gluten than the latter, and often so much gluten that it makes the dough too tenacious, and the gas produced by the yeast is unable to disturb it. For this reason, and to make the bread whiter, soft wheat is mixed with it in such quantities, as to reduce the percentage of gluten to between 10 and 15 per cent. The grains of good wheat should be plump, should slip easily through the fingers, and should not be too dark in colour and the furrows not deep. It should be free from discoloration, and there should be no signs of disease or insects. A good sample should weigh 63 lbs. per bushel. If wheat is stacked before it is dry, it becomes foxy and bitter. It is cheaper to buy the best wheat, as it produces not only the best flour, but the largest quantity. It should not be ground till it has been housed from three to six months, as flour made from new wheat is of inferior quality, and the quantity of flour is less than that produced from old wheat.

The preparation of flour consists of four operations—

Winnowing.
Washing.
Grinding.
Dressing.

In preparing soft wheat the washing process is dispensed with The machinery for dressing flour consists of two sieves. These are long tubes covered with fine silk and slanting downwards. They are kept revolving by machinery. The first tube is usually divided into three parts, covered with fine silk of three different meshes. Only the finest particles of flour can pass through this sieve and this is called "firsts." The three divisions give three different qualities. The first is used for pastry, the second for the finest bread, and the third for ordinary bread. Hospital bread and that made at foreign stations is manufactured from "firsts." The coarser flour passes into the second sieve similar to the first, but covered with silk of a larger mesh, and is also divided into three parts, the first fine, the second medium, and the third coarse. The flour obtained from the fine mesh of this sieve, is called "seconds." This fine mesh is sometimes divided into two parts, the silk covering the first being finer than the second, and thus two qualities of "seconds" are obtained. Ration bread should be made of best seconds. The flour which is too coarse to pass through the silk in the first division, falls through the "medium" mesh, and is called "thirds" or "pollards." That portion of the flour which falls through the "coarse" mesh is called "fine bran," and that which being too coarse to pass through the mesh of the sieve and passes out at the end of the tube, is called coarse bran. This coarse bran is the kind which should be given to horses, the fine being only fit for pigs or poultry. It is, however, often mixed with the coarse,

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and if so, the bran should be rejected. When "seconds" only are required, the grindstones are placed further apart, and the second sieve only is used. Whole meal, used for making brown bread, is made by grinding the wheat, no sifting takes place, and therefore the bran remains in the flour. Cones or rice flour is cheaper than wheat flour, and is used for dusting the troughs and dough boards.

Semolina is made by setting the grindstones further apart. The hardest wheat only is used. It is very nutritious, containing a larger quantity of gluten, and is used for making puddings.

100 lbs. of soft wheat will produce—

1st flour	74 lbs.
2nd flour....	8 „
Bran	16 „
Loss	2 „

In making ration or seconds flour, one-third white and two-thirds red wheat are used. The second sieve only is used, and 100 lbs. of wheat will produce 80 lbs. flour. The fine particles of bran not being sifted out of the flour, it is darker in colour than "firsts." An approximate idea of the amount of bran in the flour may be obtained by observing the colour of the flour, and the bread made from it.

Examination of Flour.

Flour is composed of roughly—

Water	15 parts.
Gluten	11 „
Starch, &c.	74 „

The examination is divided into two parts :—

First, the mode of judging its quality.
Second, the mode of detecting adulteration.

The first is simple, but the latter is generally beyond reach of anyone, but an analyst.

Judging the Quality of Flour.

1. *Sifting.*—Select four sacks of flour from the consignment, weigh 1,000 lbs., and sift through a wire sieve. The siftings should not exceed 2 ozs. If the flour is old, damp, or fermented, hard lumps will remain, and the siftings will amount to several pounds. If the flour has been fermented, meal worms and weevils will be found.

2. Throw a handful against the wall, if fresh a portion will stick. Compress another handful; it should bind to a certain

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extent. There should be no lumps or grittiness, and it should feel soft. It should not be acid in taste or smell musty. The colour should be white or have a slight golden tinge. Flour deteriorates with age and becomes acid and gritty. On the other hand, freshly ground flour does not make good bread, as the gluten requires a certain amount of heating to make it tenacious. Flour should be kept a month after being ground before using it, and if used before that time a larger amount of salt is required to harden the gluten.

3. Convert 1,000 lbs. of flour into 4 lb. loaves. Weigh the bread when cold and find the gain per cent., 280 lbs. flour should produce ninety-two 4lb. loaves (368 lbs. of bread) or a gain per cent. of 31·42. The higher the gain per cent., if the bread is well baked, the better the flour. A gain per cent. of 35 is very good for hand-made bread.

The bread should be light, sweet, well-risen, and flaky. Fermented flour produces heavy, sodden, and dark coloured bread. The dough should be elastic and spread out between the fingers like skin.

4. *Percentage of Gluten.*—Weigh 100 grains of the flour. By means of a glass rod and a little water make a stiff dough, taking care to collect every particle of the flour in the dough. Place a piece of fine muslin over a bowl and pour water over the dough, letting it run through the muslin. Knead the dough in the fingers to press the starch out, taking care not to let it break up. Continue to pour water over the dough till it comes off colourless. Collect any particles left on the muslin. What is left in the hand is gluten. Weigh this and divide by 2·9 (the proportion of wet to dry gluten). The result is the percentage of gluten in the flour. Gluten, being elastic, admits of the expansion of the dough and prevents the gas escaping, making the cavities seen in all good bread. Good gluten, when moist, should be very elastic ; it should spread like skin between the fingers and should expand like a balloon when blown into with a straw. It should be of a whitish grey colour and should smell like hot bread. When it is oily and not elastic, it has fermented, and the flour is bad, in which case it cannot retain the gas, and thus bread made from fermented flour is heavy and bad. Flour containing from 12 to 15 per cent. of gluten is the best for bread making. If the flour contains less than about 10 per cent., it is insufficient to render the bread light and porous ; if more than 15 per cent. the dough is too tenacious to be capable of being raised by the gas. In judging the quality of flour, the most important point is therefore to ascertain the quantity and the quality of the gluten. The first signs of deterioration in flour are shown by the gluten which loses its elasticity and tenacity.

5. *Percentage of Water.*—Weigh 100 grains of flour and place on a plate. Put the plate with a thermometer on it in an oven. Let the thermometer rise to 200° F., but not above it. Allow the flour to cool and weigh it again, the difference between the first and second weighing is the amount of water in the flour. A simple and

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cheap apparatus for the above test consists of two saucepans, one inside the other. The outer saucepan is partly filled with water, the flour is placed in the inner saucepan, and a thermometer inserted through a hole in the lid. The saucepan is then placed on the fire. When the thermometer rises to 200° F., the flour is removed and weighed directly it is cold. The more water in flour, the less it will absorb in being made into bread, and consequently the less will be the gain per cent. Flour should not contain more than 15 per cent., otherwise it will ferment if stored for any time. Each consignment of flour should be tested and a record kept in the "supply office." If the result of the examination is good and the bread made from it be bad, the fault must lie in the manufacture.

Mode of Detecting Adulteration.

Flour is adulterated with mineral substances and also with the flour of other grains. Flour is sometimes adulterated with chalk or plaster of Paris. Sometimes through carelessness of manufacture small fragments of the mill stones, dust, &c., become mixed with the flour. Alum and copper are sometimes mixed with it to improve its quality if fermented.

1. Weigh 100 grains of flour, place it in a porcelain crucible nd incinerate to a white ash, either over gas or a charcoal fire. Then weigh the ash, it should not exceed two grains.

2. Bake a little of the flour until it is of a deep brown. If when rubbed between the hands white particles are seen, chalk or plaster of Paris are present.

3. Shake a little of the flour into a bottle of chloroform. The flour will float and the minerals will sink.

4. Place a little of the flour in a wine-glass with water. If chalk be present and a little hydrochloric acid be added, a brisk effervescence will take place.

Adulteration of Flour with other Grains.

The microscope is necessary to detect this. However, as scarcely any other grain contains gluten to the same extent as wheat, if the percentage of gluten be good we may be sure there is no large adulteration.

Mode of Purchasing Flour.

The cheapest mode is to attend the corn market at Mark Lane, London. Small samples are examined and if found of good quality and the price is reasonable, a baking sample is sent (about 2 lbs.), tested, and converted into bread. The consignment is usually found equal to the sample but if not the matter is referred to arbitration.

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Bread.

Two kinds are manufactured.

1. Leavened or fermented bread made with yeast, ferment, or sour dough, in which the carbonic acid gas necessary to raise the bread is produced by fermentation, and
2. Unleavened bread made without any fermenting material and in which the carbonic acid gas is produced artificially. This kind of bread is sweeter but not so light as leavened bread.

Manufacture of Leavened Bread.

This bread should consist only of flour, yeast (or ferment or sour dough), salt, and water. The yeast, ferment, or sour dough being prepared, the following operations are necessary :—

1. Setting the sponge.
2. Making the dough.
3. Scaling and moulding.
4. Baking.

Setting the Sponge.

A portion of the flour to be made into bread is set aside in the trough. It is mixed up with the yeast and water and allowed to rise and fall twice. It is then broken up and mixed with the rest of the flour, salt and water added. These operations are called "breaking the sponge" and mixing the dough.

There are two kinds of sponges—

1. The "long sponge" made by mixing yeast or its equivalent with the flour and water direct, and which takes about sixteen hours to rise and fall twice, and
2. The "short sponge" made by mixing a ferment and water with the flour, and takes about eight hours to rise and fall twice.

Long Sponge.

For 1,000 lbs. flour, three gallons of yeast or 50 lbs. of sour dough are mixed with the flour set aside for the sponge, which varies as follows :—

For a	¼	sponge	....	250 lbs.
„	½	„	....	500 „
and „	¾	„	....	750 „

The quantity of yeast is always the same, viz., three gallons, but the amount of water varies with the size of the sponge, and should be enough to make a stiff dough.

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Short Sponge.

For 1,000 lbs. flour, 10 gallons of ferment are mixed with the flour set aside for the sponge, and water added as required for a $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$ sponge. The quantity of ferment used is always the same, but the quantity of water varies with the size of the sponge and should be cold in summer and luke-warm in winter. Warm water hastens fermentation. The sponge having been made, the lid is placed on the trough which is kept in a warm place. In two hours the mass becomes distended by the carbonic acid gas which gradually increases in quantity till it bursts through the sponge which then collapses. This is called the "first drop." Fermentation still going on, the mass again rises to nearly double its volume when the gas again escapes and the mass subsides—this being called the "second drop." This rising and falling would continue for twenty-four hours, but the baker always interferes at the second drop. In hot weather it is sometimes advisable to take it at the first drop for fear the mass should turn sour, but the bread in this case is likely to be dark and heavy. In cold weather the $\frac{1}{4}$ sponge is used. In summer time at home $\frac{1}{2}$ sponge is most suitable. In hot climates the $\frac{3}{4}$ sponge is preferable. The higher the temperature the more rapid is the fermentation. The amount of yeast being the same in all the sponges, the master baker having regard to the temperature uses such sponge as will rise and fall twice within certain hours. In a $\frac{1}{4}$ sponge the yeast having less flour to act on, the fermentation is much more rapid than in a $\frac{1}{2}$ or $\frac{3}{4}$ sponge. Again, with flour made from red wheat or which contains a large quantity of gluten, a $\frac{1}{4}$ sponge is advisable, whereas with that made from white wheat, a $\frac{1}{2}$ sponge would be preferable. In hot climates and at home for eight months out of the twelve a long sponge is preferable to a short sponge.

Making the Dough.

The sponge, having fermented, is broken up, and salt, dissolved in water, is added to it in the proportion of from 9 lbs. to 15 lbs. per 1,000 lbs. of flour.

Salt is used—

1. To flavour the bread.
2. To harden the dough and impart firmness to the bread. Bread made with an insufficient quantity of salt will fall to pieces on being drawn from the oven. If too much salt is used the bread becomes "salt-bound," that is, the gluten is rendered so tenacious that the gas cannot expand it. New or inferior flour requires more salt than that of good quality.

The quantity of water to be added depends on—

1. The size of the sponge.
2. The quality of the flour (fine flour absorbing most).
3. On the natural moisture contained in the flour, which varies from 10 to 18 per cent.

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The average quantity of water used in converting 100 lbs. of flour into bread is 5 gallons, including the liquor used in the sponge. A good rough rule is, that flour will absorb half its own weight of water, and so, as a gallon of water weighs 10 lbs., the amount to be used is easily calculated. The sponge being thoroughly broken up and mixed with the water in which the salt has been dissolved, the rest of the flour is gradually added and the whole thoroughly kneaded into dough of the proper consistency ; this is attained when it will receive the smart pressure of the hand without sticking to it. This kneading process is most important, as upon it depends the uniform rising of the whole mass. The first kneading takes thirty minutes ; the dough is then covered up and left to rise for one hour. This rising of the dough is called "giving proof." When the dough has risen once it is beaten down and kneaded again in order to distribute the gas evenly. It is then allowed to rise again for about an hour, but it must not be allowed to over work itself or it will turn sour.

Scaling and Moulding.

The dough is then removed from the trough and placed on the moulding table, cut up, weighed into lumps according to the weight of the loaves required, allowance being made for the evaporation. The loss by evaporation varies—

1. According to the description of bread. That surrounded by crust loses less than when there is crust only on top and bottom.
2. The state of the atmosphere. The loss being less in damp, foggy weather than in fine, dry weather.
3. The condition of the store. In a well-ventilated store the loss is greater than in an ill-ventilated one.
4. The length of time the bread is kept. The loss being greater in proportion to the length of time the bread is kept.

Bread being issued cold, dough for ration bread is scaled off at the following rates :—

Bread.				Dough.
4 lb. loaf	....	....	....	4 lbs. 5 ozs.
2½ „ „	....	....	....	2 „ 11½ „
2 „ „	....	....	....	2 „ 3 „
1¼ „ „	....	....	....	1 „ 6¼ „
1 „ „	....	....	....	1 „ 2 „

In baking on Saturday for Monday's issue, the 4 lb. loaf should be scaled off at 4 lb. 7 ozs., to admit of greater loss. The larger the loaf the less the loss in proportion—a gain of 31 per cent. in 2 lb. loaves is equal to a gain of 34 per cent. in 4 lb. loaves. After being scaled, each lump of dough is worked up a little ("handing

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up") and placed on one side to rise. After a few minutes it is roughly divided into two pieces, which are "moulded" separately—one in each hand—then pressed one on the other and left on a table for a short time in a warm situation. The lump of dough soon expands to nearly double its former size. It is then ready for the oven.

Baking.

The loaves are then placed on a peel and put in the oven. In doing this a certain amount of gas is pressed out, and for this reason tinned bread is usually much lighter than bread which has been handled after "giving proof." On being placed in the oven, the fermentation and swelling of the loaf is at first increased by the heat, but when the temperature reaches about 380° the fermentation is arrested. The mouth of the oven should not be opened until the bread has risen to its full height. Batch bread (*i.e.*, when the loaves are placed in the oven touching each other) is inferior to tinned or cottage bread, as the crust in the former often forms before the loaves have fully expanded.

Time taken in baking varies according to the heat and description of oven and size and description of loaves. The proper heat for the ovens depends upon the kind of oven used.

	In tins, or separate loaves.	In batch bread.
4 lb. loaf	1½ hours ..	2 hours
2½ „	1¼ „ ..	1½ „
2 „		
1¼ „	1 „ ..	1¼ „
1 „		

Hardness on the one hand and pastiness on the other must be avoided. The former may be obviated by rubbing a little lard over the loaf after it has been shaped. When the bread is sufficiently baked, that is, when the crumb being pressed by the hand will spring back to its original shape, it is drawn out of the oven with a drawing peel.

Amount of Water in Bread.

Under-baking consists of retaining in the loaf the excess of water which should escape during baking. It is done by putting the dough into too hot an oven, thus causing a thick crust to be formed before the bread is baked inside. Putting the bread in too slack an oven also causes the bread to be underbaked and heavy. Under-baking and adding boiled rice, rice-flour, or alum is often done to make the bread absorb and retain a large quantity of water, and thus water is sold at the price of bread. By these means 100 lbs. of flour may be made to retain 40 lbs. of water,

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whereas in properly baked bread there should not be more than 35 per cent. To determine the amount of water in bread, weigh 500 grains of crumb, place in an oven at a temperature of 212° for two hours, then weigh again, and the difference will be the amount of water contained in the bread.

Gain per cent.

Gain per cent. is the difference between the quantity of bread produced and the amount of flour used in its production. 100 lbs. of flour should at least produce 130 lbs. bread, *i.e.*, a gain per cent. of 30. The contract states that a sack, 280 lbs. of flour, shall produce 368 lbs. of bread. If the bread is not fairly made a high percentage can be obtained from inferior flour by adding an undue quantity of cones flour or potatoes, or by under-baking. In baking 2 lb. loaves at Aldershot, the gain per cent. is about 29·28, or 181·2 lb. loaves per sack of flour.

Time employed in the Manufacture of Yeast, Ferment, and Bread.

	Hours.
Simmering hops and mashing malt	1½
Mixing the above and stocking	10
Fermenting	10
Ferment	8
Setting and fermenting sponge	8
Making dough and fermenting	2½
Scaling and moulding	½
Baking	2
Total,	42½ hours.

If a long sponge is used the time taken is about the same, as the sponge takes from four to eight hours longer to work than if a ferment is used.

Unfermented Bread.

Unfermented bread is (1) that in which the dough is distended by carbonic acid gas produced by chemicals, (2) aerated bread in which carbonic acid gas made in a gasometer is forced into the dough in an air-tight trough under pressure.

(1.) Bread made with chemicals (Baking Powder).

The chemicals used are—

Carbonate of ammonia.
„ soda and muriatic acid.
„ „ and cream of tartar.

The disadvantage of using any of the above chemicals is that chemicals are seldom met with in commerce in a state of purity. Yeast is the simplest and most economical agent that can be used for raising bread. It should be always used except when field

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bakeries are being constantly moved and bread is required at short notice.

The baking powder generally used in military bakeries is "Yeatman's Yeast Powder"; $5\frac{15}{16}$ lbs. of powder to a sack of flour (280 lbs.) is the proper proportion.

Manufacture of Bread with Baking Powder.

1. Spread the flour evenly at the bottom of the trough. Sift the baking powder over the flour taking care to break up any small lumps which if left would cause a yellow stain in the bread. The dry powder and flour should be then thoroughly mixed.

2. Dissolve salt at the rate of $2\frac{1}{2}$ lbs. per sack of flour in the softest and coldest water obtainable. Water which has been boiled and allowed to get cold is the best for the purpose.

Mix the flour, baking powder and water thoroughly with a rotary motion, constantly stirring up from the bottom. The dough being properly mixed should be scaled, moulded, and placed in a quick oven. To make good bread with baking powder the bread should be in the oven within thirty minutes of adding the water to the flour. No more salt than the above mentioned proportion should be used as the baking powder turns into a kind of salt and the bread becomes heavy, dark, and briny. If the dough is allowed to lie about, the effervescence is finished before the dough is put in the oven.

Aerated bread is manufactured by placing water in a strong vessel and forcing into it carbonic acid gas to the extent of 150 lbs. to the square inch. This water is then mixed with flour and salt at a high pressure in a vessel containing a kneading apparatus. When the dough is thoroughly kneaded the pressure is released and the gas escaping raises the dough in the most expeditious manner.

Choice of Bread.

Good bread should be light and flaky, the crumb should crumble between the fingers and when fresh should be elastic and resume its place after light pressure with the hand. No part should be without small cavities of which the partitions should not be tough. The crust should be of a rich brownish yellow tint, well baked but not burnt, and neither too light on the one hand nor too dark on the other, and should be as thin as possible so far as is consistent with sufficient baking. The colour of bread made from "firsts" should be white, from "seconds" white with a slight brownish tinge. If the bread be acid, badly risen, or of a yellowish colour, it may be owing to old or fermented flour, or bad yeast being used. If the colour changes soon and fungus forms, it is underbaked and too moist. If on the other hand, it is unnaturally white, light, or brittle, alum or some other chemical may be suspected. If bread is very compact and briny it is probably "salt

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bound." If the loaf is large but wanting in firmness and insipid to the taste, sufficient salt has not been used. If the bread be sodden or heavy, the yeast has not fermented properly, or the dough has been made too slack, or badly kneaded, or not allowed to rise a second time, or flour may be fermented, or the flour may have been over dried, or the oven may have been too hot and a crust formed before the inside of the loaf is baked, preventing the escape of the steam, or the bread has not been sufficiently baked, or the sponge badly set or badly worked, or the fresh bread has been pressed down by having other loaves piled on the top of it. If the taste is sour or acid, sour dough or sour yeast may have been used in the sponge, or the sponge or dough may have been overworked, or the flour may be fermented or old. To find the cause examine first the flour, second the yeast, and third the troughs. If these are all satisfactory the sponge or dough has been overworked, or the bread has become sour from being kept too long.

A loaf having crust only on the top and bottom will become sour much sooner than one having crust all round, and will also lose more weight by evaporation. Of late at Aldershot the "Coburg" 2 lb. loaf has been substituted for the old 4 lb. ration loaf. It is of an oval shape having crust all round and on the top, and has a cross cut in the top. This loaf is popular with the soldier; it keeps fresh longer, is more palatable, and stands more knocking about than the 4 lb. ration loaf. Adulterations are more difficult to detect in bread than in flour.

The practice of introducing boiled potatoes into bread is almost universal; the only objections are that the bread is not so nutritious and that it soon becomes sour. Alum, carbonate of ammonia, and sulphate of copper are used to disguise the bad quality of the flour used.

Alum is used for two purposes—

1. To enable flour of bad colour and inferior quality to produce bread equal in appearance to that made from good flour.
2. To enable the flour, by hardening the gluten, to retain a larger proportion of water, thereby increasing the weight of the loaf.

Most bakers use a mixture of salt and alum known as "hards" or "stuff."

To detect alum mix 2¼ ozs. of logwood chips in a bottle with 4 ozs. of spirits and let it rest for twenty-four hours. A few drops poured on moistened bread or flour will show a dark violet colour if alum be present. If no alum be present the colour is bright red. When only small quantities of alum are present it takes several hours for the violet colour to appear. A comparative experiment should be made on pure bread or flour as the difference in colour is most marked.

Another mode is to pierce a loaf twelve hours' old with a knife

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made very hot. If alum be present it will adhere in small particles to the knife and will show itself by a peculiar smell. If bread looks unnaturally white, full of cavities, loses much weight, and becomes brittle and dry, alum may be suspected.

Alum may also be detected in bread by laying a piece about 2 inches square upon a saucer and then pouring over it a small quantity of tincture of logwood which has previously been mixed with its own bulk of carbonate of ammonia solution. If alum be present, the bread will turn blue, whereas, if it be free from any admixture of the kind, it will become pink.

Carbonate of ammonia is used in order to produce light and apparently good bread from bad and sour flour. It may be detected—

1. By its smell, which is produced by covering a small quantity of the suspected bread with caustic potash.
2. If a glass rod dipped into strong acetic acid be held close to but not touching the slice of bread covered with caustic potash, a white cloudy vapour will appear if only a small quantity of ammonia be present.

Sulphate of copper is used to make the bread rise well and to make it retain a larger amount of water. To detect it, place a glass rod dipped in ferro-cyannide of potassium over a slice of bread; if even very small quantities of copper be present the bread will turn a brick red colour.

State of the Law as regards Bread, &c.

The baker is not now allowed to sell at so much per loaf; he must sell at so much per lb. He must keep near the counter a beam with proper scales and weights, and if sending out bread for delivery in any cart or carriage he must provide it with the same. Penalty for refusing to weigh bread when required, £5. The baker may make his bread of wheat, barley, rye, oats, buckwheat, Indian corn, potatoes, peas, beans, or rice, with salt, water, eggs, milk, barm, leaven, and potato, or other yeast and with no other ingredient whatever. Penalty for infringing this rule not more than £10, or six months' hard labour in default.

If bread be made wholly or partially of peas, beans or potatoes, or of any other grain than that of wheat, it must be stamped with a capital M under a penalty of 10*s.* per lb. Any baker exercising his calling on the "Lord's Day," or after 1.30 p.m. on that day selling any bread, &c., is liable to a penalty of 10*s.* for the first offence, 20*s.* for the second.

Biscuits.

Ship biscuits consist of only flour and water kneaded into a thick paste, cut into the proper shape, docked and baked in the oven. They are made by machinery. Bread made with yeast, &c.,

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soon becomes musty, whereas biscuits will keep for a long time. They are made in the form of flat cakes to ensure their being deprived of moisture in baking. They are generally made of the meal of wheat from which only the coarsest bran has been separated.

Biscuits are a convenient and compact form of food, especially as regards carriage and keeping, and are well adapted for the use of soldiers in the field. If properly packed in casks or tins, they will keep a long while, but if exposed to damp they soon become mouldy. They contain much more nutriment than the same weight or bulk of bread, $\frac{3}{4}$ lb. biscuit being equal to 1 lb. of bread. This is the ration on peace service, but in the field 1 lb. of biscuit is issued in lieu of $1\frac{1}{4}$ lbs. of bread.

In the manufacture of biscuits there is a loss of about 10 per cent., whereas in the manufacture of bread, there is a gain of 30 per cent. The reason of this is, that biscuits being flat, compact, and highly dried in baking, lose not only the water used in making the dough, but also the hygroscopic water in the flour.

Choice of Biscuits.

Biscuits should be of a light yellow colour, highly dried and crisp, but not burnt. They should float in water, and when struck give a ringing sound. A piece put in the mouth should thoroughly soften down. They should be free from all insects. A ship's biscuit weighs about 4 ozs. For field service they are packed in tin lined cases or in bags.

Meat Biscuits.

Meat biscuits are dry, inodorous, brittle, flat cakes. 1 lb. of biscuits, consists of $\frac{1}{2}$ lb. wheaten flour and the nutriment of 5 lbs. of beef. They are chiefly manufactured in the United States in Texas, where meat is abundant and cheap. They may be eaten dry or may be broken up in about twenty times their weight of water and boiled for half an hour with salt, &c., when they make an excellent soup. One ounce of biscuit will produce a pint of good soup.

Unfermented Cakes.

The "chuppaty" of India is simply made with water and salt. It is readily made, is agreeable to the taste, and nutritious.

The Australian "damper" is simply made by digging a hole in the ground, filling it with a wood fire, and when the fire has thoroughly burnt up, removing it, laying the dough on a large stone, covering it with a tin plate and heaping the hot ashes round and over it. In a campaign every soldier, if he could get flour and wood, would soon learn to bake a cake for himself. The only point

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of manipulation which requires practice, is not to have the heat too great: if it be above 212° too much of the starch is turned into dextrine, and the cake is tough. Exposed to greater heat and well dried, the unfermented cake becomes biscuit.

FIELD BAKERIES.—SERVICE ABROAD.

Bread is supplied to an army in the field under two systems.

1. The troops in front of the advanced depôt are supplied by field bakery companies of the Army Service Corps. These advance with the troops and are divided into six sections, as follows. (See pages 132 and 133 of the Field Army Establishments, Service Abroad, 1891.)

	Bake for
No. 1 Company—	
No. 1 Section, 10 ovens ..	Cavalry Division.
2 „ 10 „ ..	
3 „ 10 „ ..	Army Corps Head Quarter Troops.
4 „ 10 „ ..	1st Infantry Division.
5 „ 10 „ ..	
6 „ 10 „ ..	
No. 2 Company—	
No. 1 Section, 10 ovens ..	2nd Infantry Division.
2 „ 10 „ ..	
3 „ 10 „ ..	
4 „ 10 „ ..	3rd Infantry Division.
5 „ 10 „ ..	
6 „ 10 „ ..	

FIELD BAKERIES.—HOME DEFENCE.

If the company is equipped with Grove's travelling ovens, as in the case of a field bakery organized for home defence, it is distributed into six sections with four ovens each. The establishment of bakers for each section is, as shown on page 131, for a brigade of the field army.

Each section of four ovens is capable of producing, when in full work, 5,000 rations (6,250 lbs.) in 24 hours (8 batches).

2. Issuing stations at the base, along the line of communication, and at the advanced depôt, are supplied by field bakeries of the necessary strength, which are under the local supply officer and are not provided with transport.

The bakery company, as a rule, should not be divided, but should be encamped as near as possible to the troops. The officer in command holds on charge all bakery equipment, and is a bulk accountant for bread and bakery supplies. The latter are obtained as required from the advanced depôt drawn by the bakery transport of the company, and brought on charge by way-bill. The officers in charge of brigades, &c., on receipt of the demands for rations, issue checks to the regiments on the bakery for the required amount of bread. The regiments send their own transport to the bakery, present the checks, and receive the bread. At the end of

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each day the officer commanding bakery company makes out a way-bill for the quantity issued to each brigade, &c., and forwards it for signature to the officer concerned. The officer commanding bakery company strikes off the amount issued, and the officers in charge of brigades, &c., take on the quantity received by regiments by way-bills on their provision store accounts.

When the company is together, the senior master baker (a warrant officer) compiles the bakery accounts and superintends the bakery. When the various brigades are detached, it is more convenient to break up the bakery company into sections. When the bakery company is thus split up, it would be impossible for the officer commanding the company to be responsible for the bakery accounts, and consequently the officer in charge of supplies with the brigade, &c., would become the accountant, but the equipment would remain on charge of the officer commanding bakery company.

Pages 132 and 133, Field Army Establishments, Service Abroad, 1891, show the strength of each company. In the Field Service Manual, Army Service Corps, the bakery equipment, materials, and mode of packing will be found.

Field bakeries at issuing stations are under the local supply officer, and being of a somewhat permanent character, the field ovens would be supplemented by brick ovens.

The number of bakers for each station would depend on the number of troops to be supplied, but the following are the numbers allowed. (See Field Service Manual, Army Service Corps, pages 34 and 35.)

	S. 2 M. Sergt.	S. Serjeant.	Serjeants.	Corporals.	2nd Corpls.	Privates.	Total.
L. of C. and Advanced Depôt	1	1	4	4	4	36	50
Base	1	1	2	2	2	22	30

The equipment for each of these stations is half that of a section of ten ovens, except the single articles, which are the same, and two men per Aldershot oven are ample. The ordinary day's baking for each oven amounts to four batches of 108–1¼ lb. loaves, or 432 rations.

Field Bakery.

The various operations of bread making described under the head of "bakery" can be carried out in the field. The brewery operations are performed in "field kitchens" and a "bell tent," the "setting sponges," "dough making," &c., in a marquee, and the baking is done in "field ovens" of various kinds.

Field Kitchens.—A kitchen for heating water for yeast making and for sponges, for cooking the men's rations, &c., can be made as follows :—

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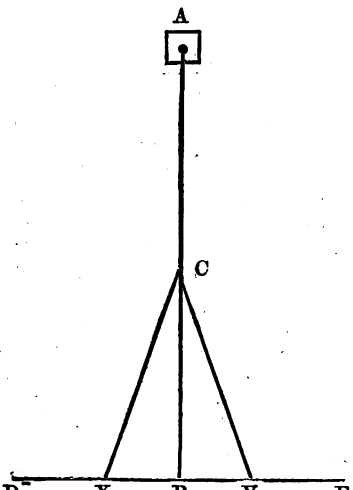
Temporary Kitchen.—Dig a trench 6 feet long, 9 inches wide, and 18 inches deep at mouth, sloping upward to 4 inches at the other end, where a rough chimney, 2 feet high, is built of sods taken from trench. The mouth should face the wind. This trench will hold six Flanders kettles, and will do the bakery work for a brigade and cook for 50 men.

Kitchen for Marshy Land.—Cut sods 18 inches long, 9 inches wide, and lay them in two parallel lines 2 feet 6 inches apart, and 6 feet long. Lay wood all along the bottom of the trench. This trench will hold ten Flanders kettles, hung by means of a stick through the handle, the ends of the stick resting on the walls.

Broad Arrow Kitchens.—If the bakery is likely to be encamped for some days, a broad arrow kitchen should be made which will do the bakery work for three brigades and will cook for about 220 men. Select site for chimney and mark out a square 3 feet by 3 feet. Drive a peg in the centre of the square. From this peg (*a*) in the direction of the prevailing wind draw a line 26 feet long and drive another peg (*b*). At a point 14 feet from chimney drive a third peg (*c*); this will mark the point where the three trenches forming the broad arrow will converge. At the point B at right angles to AB draw a line DE 15 feet long, driving pegs at the points D and E. At X and Y 5 feet from B on each side of it drive a peg. Then the pegs X, B, and Y, mark the mouths of the three trenches. The trench DE is 2 feet wide and 21 inches deep. The trenches XC, BC, and YC are 9 inches wide, splay mouthed, 18 inches deep at mouths sloping up to 6 inches at C. The trenches XC and YC should not converge exactly opposite each other, or the draft will not be good. The trench CA, which forms the flue, should be 9 inches wide, sloping from 6 inches deep at C, to 4 inches deep at A. The flue is covered with sods, grass downward. The chimney is built of sods to a height of 5 feet. The trenches XC, BC, and YC, are covered with clay supported by pieces of clay, flat stones, &c., nine holes are left in each trench for the camp kettles to fit into. The clay is moulded round the kettles so that they fit exactly, their bottoms resting on the edges of the trench. This kitchen will thus hold twenty-seven camp kettles. The fire should be laid in the trenches and the kettles filled with



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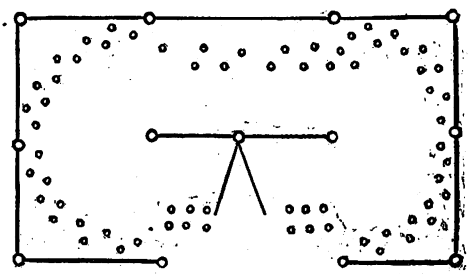
water and placed in position over-night, so that in case of rain the wood may be kept dry and ready for lighting in the morning.

Instructions for Pitching Bell Tent.—Two men are sufficient to pitch a bell tent. No. 1 standing where the pole of the tent is to rest, drives a peg between his feet. He then takes three and a-half paces to his front (where the door is to be) and drives a peg. He then returns to the centre peg, takes three and a-half paces to his right and left and drives two more pegs, then returns to centre peg, takes three and a-half paces to the rear and drives a peg in like manner. No. 2 meanwhile gets tent ready, placing door uppermost, top to the rear. The ropes are unrolled and the door unhooked. The remainder of the pegs are distributed in a circle round the four pegs. The tent is then dragged to the ground, which it is to occupy, the 2nd ropes on each side of the door are attached to the front peg, the 6th ropes on each side of the door are attached to the right and left pegs, then the 5th rope from these is attached to the rear peg. The pole is then inserted and the cap driven on, the tent raised till the heel of the pole rests against the centre peg, the five ropes tightened, the remaining pegs driven in a line with the seams of the tent.

Instructions for Pitching Marquee.—Clear ground, lay ridge pole on ground. Should several marquees require to be erected the ridge poles should be dressed not less than 12 yards apart. Drive a peg at each end and one in the centre. From each of the end pegs describe a semicircle with a radius of 6 yards, with one of the marquee ropes. Drive in a peg on the semicircle in a straight line with the ridge pole, and one at each end of the semicircle at right angles with the ridge pole. Drive in five pegs at equal distances at each side between the centre and the end pegs of the semicircle, which will then consist of thirteen pegs. Complete the other end in the same manner. Then one foot inwards and between each two pegs of the outer circle drive another peg for the inner roof.



For the sides, 18 inches from the end of each ridge pole, and 5 yards from it drive in two pegs ; for the back, drive four pegs between these two, dividing the distance equally in a line parallel to the ridge pole, and 1 foot inwards drive a peg between each two of these six pegs. For the door leave a sufficient space in the centre, and on each side drive three pegs, 5 yards from the ridge pole, then

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1 foot inwards drive three pegs on each side of the doorway. This makes a total of 62 pegs.

For the four large pegs for weather lines drive these at the corners where two lines would meet if drawn at right angles to each other from each end of the semicircle.

To Erect the Marquee.—Place the poles with their heels resting against the three pegs which were first driven, adjust the ridge pole and the outer and inner roof of the marquee, fit on vases, and lead the weather lines to their respective pegs. To raise the marquee ten men are required ; two to each pole, and one to each of the four weather lines. A non-commissioned officer should see that the three upright poles are raised together and are dressed perpendicularly. The weather lines are then slipped on the pegs, and the bracing lines of outer roof are put on the outer row of the semicircle, and those of inner roof on the inner semicircle. The curtain is then hooked on and pegs driven round the bottom for each loop. A small trench is dug outside the curtain to drain the rain-water off.

Field Ovens.

These are divided into the following classes, viz. :—

1. "Travelling."
2. "Ground."
3. "Improvised."

The first are used at the "base," on the "lines of communication," and with the bakery column when the roads are sufficiently good. The second are used to supplement the above at the "base" and on the "lines of communication," and with the bakery column when the roads are impassable for heavy wheeled vehicles. The third are used to supplement the above.

Travelling Ovens

Are of two kinds—

1. Groves' Travelling Oven.
2. Perkins' Steam Travelling Oven.

The latter is now obsolete, and although there are two in use at Aldershot they will not be used on active service in future. They have been superseded by the "Groves' Travelling Oven," twenty-four of which would be kept at the base, and should the nature of the ground admit they would also be supplied to the bakery column. The body of the oven is mounted on four wheels, and consists of four ovens fitted over and at the sides of the furnace. They are heated by hot air which circulates round them. The loaves are placed in four trays on rollers, each of which trays fills one of the ovens. Each tray holds twenty-four loaves. There is a duplicate set of trays with each oven, so that a fresh batch may be put in directly the baked bread is drawn.

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Working.—

1. The chimney end should face the wind.
2. The trays should be drawn and reversed during baking.
3. The doors should be opened for a short time to allow the steam to escape.
4. The flues must be cleaned daily (especially if coal is used). Wood is the most suitable fuel.

If necessary this oven can be heated and baking carried on, on the march.

Weight.—The weight of the oven is 2 tons 6 cwt., and should be drawn by four horses.

Time and Fuel.—

Time for first heating	....3 hours.		
Amount of fuel	Wood	....	200 lbs.
	Coal	....	100 „
	Coke	....	100 „
Time for baking ...	....2 hours.		
Amount of fuel per hour after first heating	Wood	....	70 lbs.
	Coal	....	50 „
	Coke	....	50 „

Capacity.—This oven will hold 96-2½ lb. loaves per batch, or 192 rations. Therefore four ovens will, in 6 batches, bake 4,608 rations or more than sufficient for a brigade in about 13½ hours. In performing this work the four ovens will burn about 4,440 lbs. of wood, or roughly 1 lb. wood to every ration. A good rule to calculate the amount of wood required with any kind of field oven is 1lb. of wood for every pound of bread produced. This always gives an ample amount.

Ground Ovens

Are of two kinds—

1. The Aldershot Oven (Mark II.)
2. The Wingate Oven.

The Aldershot Oven consists of two sections

weighing....	....	....	186 lbs.
1 bottom....	....	....	66 „
2 ends	....	....	52 „
4 bars	....	....	28 „
9 tins	....	....	36 „
1 peel	....	....	6 „
	Total	....	374 lbs.

When the tins are used the bottom is not required. The length of the two sections when up is 5 feet 1 inch, width 3 feet 6 inches. A section of ten ovens when built up with sods, 4 inches being left

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between each oven, occupies a frontage of 40 feet, and a depth of 7 feet.

Time.—Time for erecting and heating—

Erecting 10 ovens	1½ hours.
1st heating, 1st day	4 „
„ „ 2nd „	2 „
2nd and subsequent heating	1½ „
Baking	1¾ „
1st day, 4 batches	14½ „
2nd „ „ „	12 „

Capacity.—Each oven holds 54–2½ lb. loaves, or 108 rations. 10 ovens, 1 batch, 1,080. 10 ovens, 4 batches, 4,320, or about sufficient for a brigade.

Fuel.—Wood required for each oven—

1st heating, 1st day	300 lbs.
„ „ 2nd day	150 „
2nd and subsequent heatings	75 „
10 ovens, 1st day	5,250 „
„ „ 2nd day	3,750 „

One baker for each oven is sufficient, but on service two are allowed.

Erecting Ovens.—Select a gentle slope, the mouths of the ovens to face the prevailing wind, as the ovens heat quicker and the smoke is blown away from the bakers. A "master" and nine men are required to pitch ten ovens. The "master" and five men mark out and clear the ground, dig centre trenches, put up sections, mark out bakers' trench, build walls, and level roof, four men cut turf sods, dig out bakers' and other trenches, throw earth over ovens, split wood, and light fires. Tools required—4 spades, 4 shovels, and 2 picks. The master baker should have a line 40 feet long, with ten knots, where the centre of each oven will rest. The 1st knot will be 2 feet 9 inches from the end of the line and the others 2 feet 1 inch in succession from it. The ground to be occupied by the ovens, which will be a rectangle 40 feet long and 6 feet 1 inch in depth, should be marked out, a stake being driven at each corner, and one at each knot. The ground is then cleared and sods removed if on turf. The outer ribs of each section are inserted in the eyes of the cross bars, the two sections are laid on the ground with their ends overlapping about 1 inch. The ends of the ribs and cross bars are sunk flush with the ground. The back ends of the ovens are then placed in position. Next mark out bakers' trench 1 foot from front of ovens, 2 feet wide and 1½ feet deep, 148 sods are required, each 1½ feet long, 1 foot wide and 4 inches deep. The sod wall is now built round the ovens, one man takes each end, three the back and one the front. Each course should be completed before another is begun. The sods are laid grass downward and are built in the same manner as bricks, the joints being "broken." Simultaneously the bakers' trench is dug

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and the earth thrown over the ovens. With this earth the sods are well bedded and backed. The joints between sections are covered with clay or sods grass downward. The tops of the ovens are covered with earth beaten down to a height of 6 inches in front, sloping backwards till it just covers the back ends of the ovens. This gives a fall to drive off rain-water. The roofs of the two outer ovens should be drained both outwards and backwards. A trench 1 foot wide and 9 inches deep should be dug round the ends and backs of the ovens about 3 inches from them to drain off rain-water. The bakers' trench should also be drained.

Directions for Working.—1. Every night the wood should be ready laid for lighting in the morning. It is thus kept dry.

2. When the oven is heated the embers are drawn out with a rake and a small quantity of ashes left and raked evenly with the floor.

3. The tins containing the dough should not be put in till twenty minutes after the fire is drawn.

4. When the top of the oven sinks to less than 14 inches from the bottom, the ovens should be taken to pieces and beaten into shape with mauls.

5. When the dough is placed in the oven (which is done by sliding the tins in with the peel) the door is placed in position and the crevices closed with clay and cow dung.

The Wingate Oven consists of eight triangular pieces, so curved as when placed together they form an oven resembling a bee-hive. There are two kinds—

The heavy weights	300	lbs.
„ light „	162½	„
Time.—Time for 1st heating	2½	hours
„ „ 2nd and subsequent heating	¾	„
„ „ baking	1½	„
Fuel.—Wood, 1st heating	100	lbs.
„ 2nd and subsequent	40	„
Capacity.—No. of loaves of 2½ lb. in each batch	80	

Erecting and Working.—Make a platform of clay or brick and place the pieces of the oven in position resting one against the other, cover the whole with a layer of clay and cowdung, except the openings for the chimney and door (the latter is a round hole cut in one of the sections). When the fire has been lighted the opening is closed by hooking on the door, which is made of iron and fitted with handles. When the oven is heated the embers are raked out, the chimney closed with a stone, and the loaves of dough are placed on the platform and when baked are drawn with a peel.

Improvised Ovens.

1. *The Brick Oven.*—Only suitable when troops are stationary for some days. Consists of 540 bricks—

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In the bottom	120	Total, 540.
„ „ arch	240	
„ „ back and chimney	100	
„ „ front	80	

Time.—Time, 1st heating	3	hours.
„ 2nd „	1	„
Setting and drawing	½	„
Baking	1½	„

Capacity.—Capacity = 96 2½ lb. loaves per batch ; 4 batches in 12 hours = 768 rations ; six ovens will bake for a brigade.

Fuel.—Wood for 1st heating	300 lbs.
„ „ 2nd „	75 „

Erecting.—Mark out a space 9 feet by 3 feet 9 inches. Excavate to a depth of 4 inches, keeping sides neatly cut. Lay firm sand on earth to a depth of 1 inch. Lay in the sand 120 bricks, 10 across and 12 down, taking care to break the joints. Along the sides of this platform build 2 courses of brick, beginning at a distance of ½ a brick from mouth end. Take two large sacks filled with earth and lay them along the centre of the floor of the oven. Cover with earth, moulding it to form a framework for the arch. Place 2 bricks on end, one above the other, at each end of the floor—this will give the proper height of the arch—18 inches. Then build the arch over this framework, putting extra thickness of mortar between the outer edges of the bricks, so as to form the arch, which should be built simultaneously from each side. When the sides have approached each other to within the distance of the thickness of a brick, the key-stones, which consist of bricks chipped into a wedge shape, are dropped in and the arch is then completed. The sacks and earth are now removed. The back is next built, and consists of 6 courses ; the 1st and 2nd course of 4 bricks each, the 3rd of 3½ bricks, the 4th of 3 bricks, the 5th of 2½ bricks, and the 6th of 2 bricks. A whole brick is now taken from the centre of the 4th course, and ½ a brick from the centre of the 5th and 6th courses to form an opening into the chimney. The latter consists of 20 courses of 4 bricks each. An opening is left opposite the opening in the back of the oven. The front is built by laying 2 courses of 1½ bricks at each corner of the front of the floor. The arch for the door is 18 inches high. The arch is commenced at the 3rd course and is built of ½ bricks. The front is now completed by being built up to a height of 9 bricks. The arch is now covered with loose earth and a trench is dug for the bakers to work in, 1 foot from mouth of oven. When the oven has been heated and the bread put in, the door is closed by means of a board lined with tin or sheet iron, and a flat stone or sod is placed on the chimney.

2. *The Hughes' Oven* is made of the bottoms of five Aldershot Ovens and four half tires of wheels.

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Time.—Time erecting .... 1 hour 30 minutes.
„ 1st heating .... 4 hours.
„ 2nd „ .... 2 „
„ baking .... 2 „

96 2½ lb. loaves per batch, 4 batches in 12 hours = 768 rations.

Fuel.—For 1st heating .... 400 lbs. wood.
„ 2nd „ .... 150 „ „

Six of these ovens will bake for a brigade.

Erecting and Working.—The site having been selected and cleared (each oven requiring a space of 9 feet by 5½ feet), the 4 ribs are driven into the ground, 2 "bottoms" are placed lengthways against the ribs, one on each side, their lower sides being pinned close to the ribs. The 3rd sheet is then placed on top of the ribs, overlapping the 2 side sheets. A 4th sheet is adjusted as a back, and the whole is covered with earth and built up with sods in the same manner as the Aldershot Oven (Mark II.). The 5th sheet is used as a door, the crevices being stopped with clay or mud. Trenches are dug in the same manner as for the Aldershot Oven, and the working, baking, &c., is similar. Tins to contain the bread may be made from biscuit tins cut down to the required height.

3. *The Gabion Oven* consists of forty-two bands of "Jones' iron band gabion." Twenty-one are laid each way and interlaced, the ends being turned over to keep the whole tight. Four half tires are required to support it.

Time for erecting .... 1 hour.
„ heating ....
„ baking .... } Same as Aldershot Oven.

Wood for 1st heating ....
„ 2nd „ .... } „ „ „

Capacity.—66 2½ lb. loaves per batch.
4 batches in 12 hours.
8 ovens required for brigade.

Erecting and Working.—This oven is erected in the same manner as Hughes' Oven. The working is similar to the Aldershot Oven (Mark II.). The back and door of the oven can be made of sheet iron or boards lined with tin.

4. *Hurdle Oven.*—Only suitable for hot climates. The time for heating and baking, and consumption of fuel, is the same as the Aldershot Oven (Mark II.).

Capacity.—Number of loaves same as Gabion Oven.

Erecting and Working.—Select site, and, where the back of the oven is to rest, mark out a semicircle 3 feet 6 inches wide and 3 feet 8 inches high. On this semicircle stick into the ground 9 poles, 5 feet 6 inches in length, at equal distances from each other.

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Section III.

FORAGE.

FORAGE is a term given to all substances used as food for horses and mules. It usually consists of hay, straw, and oats. Other grains such as maize, barley, peas, beans, &c., may be substituted for or given in addition to oats, and in like manner grass, chopped straw, &c., may be substituted for hay. As a rule, straw is only used as litter or bedding for horses. A horse will not thrive on grain only as a certain amount of bulk is required to fill his stomach. This is particularly noticeable when compressed forage is issued (20 lb. per day being the ration). If a little grass or hay can be given in addition horses will do well on it, but if they are restricted to the ration of compressed forage they are found to fall off in condition. On the other hand, horses will not work and retain condition on hay and grass only. The amount of nutritive matter contained in hay or grass is insufficient to supply the waste of muscular tissue which takes place when the animal is called upon to do fast or hard work. It will, therefore, be seen that grain and hay or its equivalent must be given in judicious proportions in order to retain the horse in health and enable him to do his required work. The value of any article as food depends on the amount of nutritive matter contained in it, which can be ascertained by chemical analysis, but there are other important points to be taken into consideration, viz., digestibility, readiness of assimilation, absence of unduly heating properties, &c., which can only be ascertained by practical experience. The amount of food to be given to horses varies of course with individuals and circumstances. The daily allowance for each horse or mule is laid down in the Allowance Regulations, Section IV, and is supposed to be ample for an average horse doing average work. Certain variations as regards size of horses and mules and the nature of their work are allowed for, and a "scale of equivalents" which enables the horse's diet to be varied to a certain extent is also

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authorised. Further, by special authority, and in certain circumstances without special authority, Commanding Officers have power to regulate the amount of forage to be given to the horses of their regiments or corps according to the work they are doing, by leaving a certain portion of the authorised ration undrawn while their horses are doing light work so that a reserve may accumulate to be drawn upon when the horses are hard worked.

Hay.

The quality and value of hay depend:—

1. On the grasses and herbage of which it is composed.
2. On the soil upon which it has been grown.
3. On the time at which the grass has been cut.
4. On the way in which it has been saved.

These points will be considered in detail:—

1st. The grasses and herbage contained in the hay.—The value of the different varieties of grass have been determined partly by chemical analysis and partly by experiments in feeding animals exclusively on certain varieties. Some grasses are known to be good both in the form of green forage, and also when converted into hay. Others again, though useful for feeding purposes as grass, become practically worthless when made into hay. The nature of the soil and the climate also affect very much the quality of various grasses. For instance, Yorkshire Fog in the United Kingdom is accounted as a fair grass only, whilst in New Zealand it is in high repute. Again, one of our worst reputed grasses, viz., Couch Grass, is largely grown for feeding purposes on the Continent. It is therefore difficult to draw a hard and fast line between good and bad grasses, and hay containing so-called inferior grasses should not be too hastily condemned as worthless, nor should it be judged entirely by the grasses of which it is composed.

For convenience of description, grasses are divided into natural and artificial. Natural grasses are true grasses, artificial grasses on the other hand, comprise Clovers, Sainfoin, Lucerne, Vetches, &c., which from a botanical point of view are not grasses at all. For convenience of memory the various grasses may be classed under the heads of good, fair, inferior, bad, and herbage.

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The good grasses are :—

1. English Rye Grass.
2. Italian Rye Grass.
3. Meadow Fescue.
4. Timothy or Cat's-tail.
5. Meadow Foxtail.
6. Crested Dog's Tail.
7. Sweet Scented Vernal.

The fair grasses are :—

1. Cock's-foot.
2. Rough Stalked Meadow Grass.
3. Smooth Stalked Meadow Grass.
4. Yorkshire Fog.
5. Sheep's Fescue.
6. Yellow or Golden Oat.

The inferior grasses are :—

1. False Oat.
2. Field Brome.
3. Wavy Mountain Hair.
4. Fiorin or Bent (of various kinds)
5. Barren Fescue.
6. Quaking Grass.

The bad grasses are :—

1. Barren Brome.
2. Field Barley or Squirrel Tail.
3. Couch Grass.
4. Tufted Hair Grass.
5. Slender Fox Tail.
6. Reed Sweet Grass.
7. Ribbon Grass.

"Herbage" is a conventional name for plants (other than weeds) in Hay. There are the following varieties :—

1. Common or Red Clover.
2. White or Dutch Clover.
3. Valerian Clover.
4. Hop Trefoil.
5. Bird's Foot Trefoil.
6. Blue Vetch.
7. Yellow Vetch.
8. Kidney Vetch.

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9. Sainfoin.
10. Lucerne.

Weeds.—The weeds most commonly found in hay are :—

1. Ribbed Plantain.
2. Colt's Foot.
3. Silver Weed or Goose Grass.
4. Black Head or Knap Weed.
5. Rattle.
6. Dandelion.
7. Cat's Ear.
8. Buttercup.
9. Marguerite or Ox Eye Daisy.
10. Wild Carrot.
11. Lamb's Tongue.
12. Rushes and Sedges of various kinds.
13. Mare's Tail.

The presence of weeds in hay is objectionable, but they indicate the nature of the soil on which it has been grown, and if early flowering weeds such as buttercup are found in flower, it shows that the hay has been cut in good time.

Rib plantain, colt's-foot, silver-weed, and black-head furnish indications as to the age of the hay.

Rattle, rushes, sedge, and mare's-tail show that the hay has been grown on wet and dirty soils. Cat's-ear is most objectionable as it is very bitter, and horses will reject hay containing much of it.

2nd. The soil on which the hay has been grown. As before mentioned, the nature of the soil on which grasses are grown, greatly affects their value for feeding purposes. In selecting grasses for the production of hay, the peculiarities of the soil must be considered. The best grasses in unsuitable soil soon become comparatively worthless. Hay composed of rye grass grown in an unsuitable soil would not be as good as that composed of say cock's-foot grown on the same soil but which was suited to it.

The "locality" also largely affects the value of grasses. Hay composed of good grasses grown under the shade of trees would be insipid and worthless.

Upland, Lowland, and Water Meadow Hay.

Hay may be broadly distinguished as either upland, lowland, or water meadow. Upland is the best. None but

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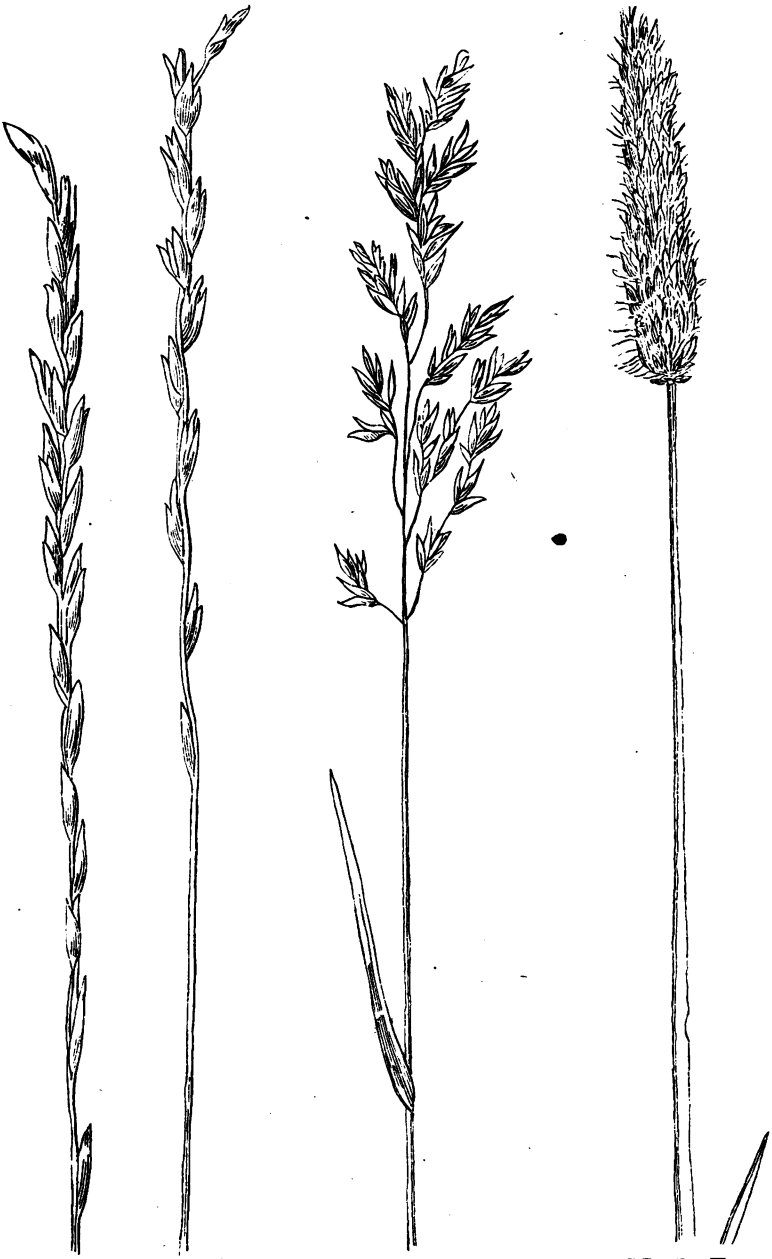
GOOD GRASSES.



Rye Grass
(Lolium perenne)

Meadow Fescue
(Festuca pratensis)

Meadow Fox tail
(Alopecurus pratensis)

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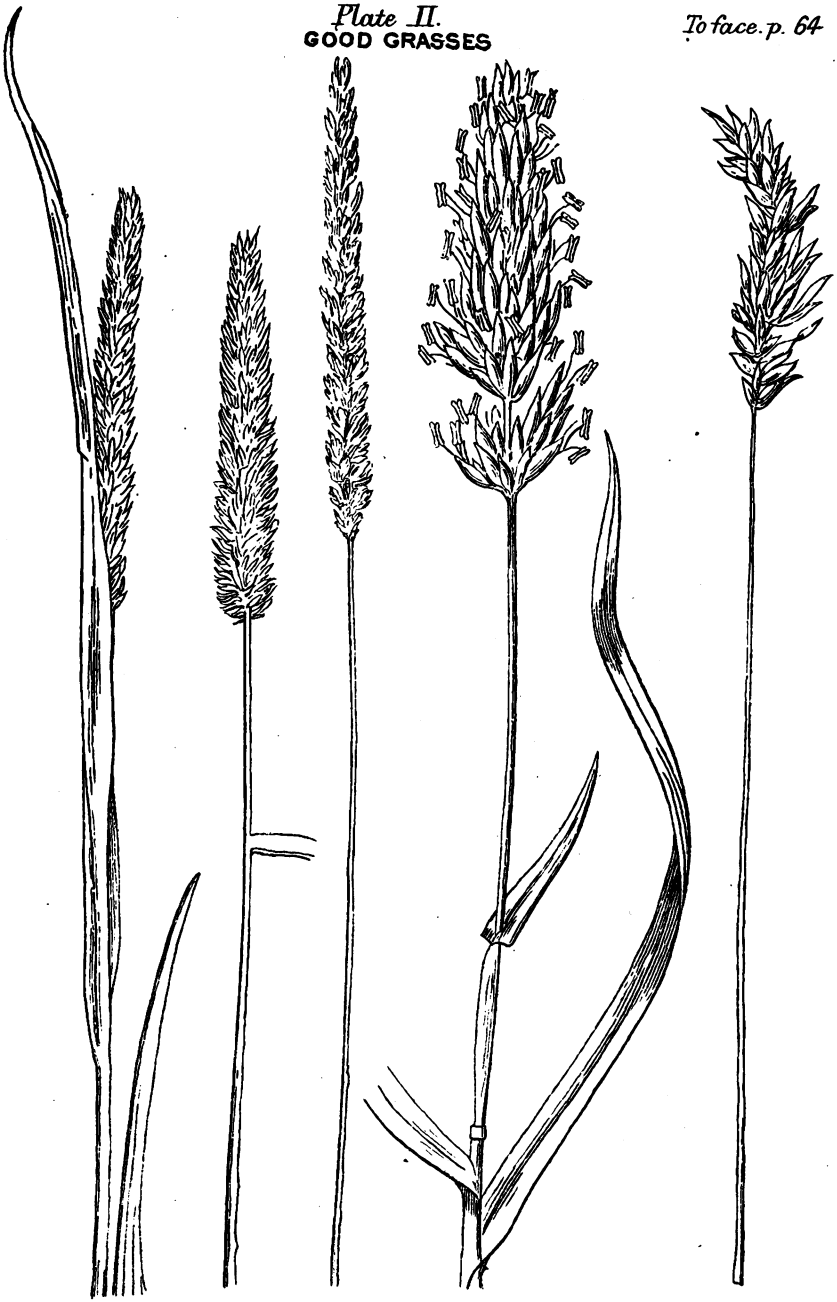

Meadow Cat's tail or Timothy. (Phleum pratense) *Crested Dog's tail. (Cynosurus cristatus)* *Sweet Vernal in Flower (Anthoxanthum odoratum)* *Sweet Vernal in Hay*

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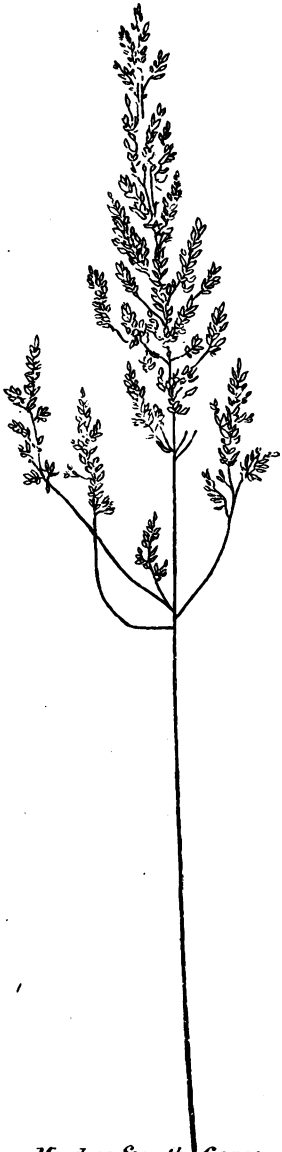
Plate III.

FAIR GRASSES.

To face p. 64.

Cocksfoot.
(Dactylis glomerata)



Meadow Smooth Grass.
(Poa Pratensis)

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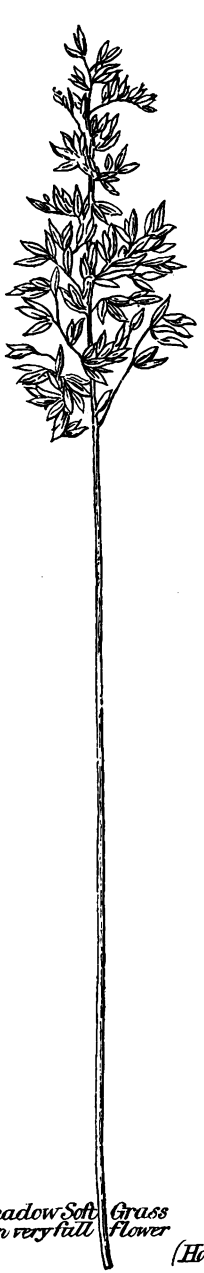
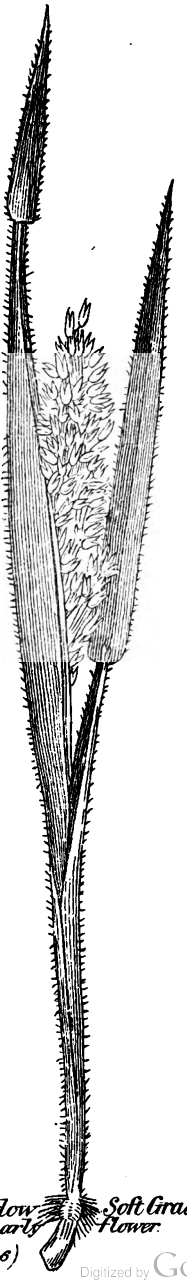
FAIR GRASSES CONTINUED.



Meadow Soft Grass in very full flower



Meadow Soft Grass in early flower. (*Holcus mollis*)

Yorkshire Fog in rather early flower (*Holcus lanatus.*)

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Plate V.

To face p. 64.

AN INFERIOR GRASS.

A FAIR GRASS.

Rough stalked Meadow Grass
(Poa trivialis.)

Quaking Grass.
(Breza Media)

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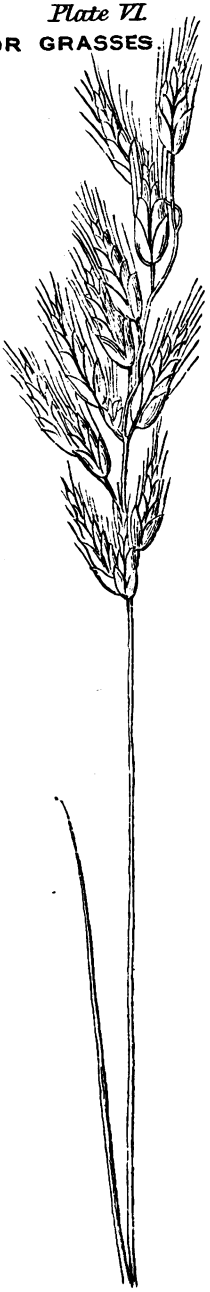
Plate VI.

INFERIOR GRASSES.

False Oat.
(Avena elutior.)
Flowering head only



Field Brome.
(Bromus arvensis.)

Ficrin Grass.
(Agrostis stolonifera.)

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BAD GRASSES.

Squirrel tail or Common Meadow Barley (Hordeum pratense)

Slender Foxtail (Alopecurus agrestis)

Tufted Hair Grass (Aira cæspitosa) Flowering head only

Rushes.

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Plate VIII.

WATER MEADOW GRASSES.

To face p. 64.

Reed-Sweet Grass.
(Glyceria or Poa aquatica)

Ribbon Grass.
(Digraphis arundinacea)
Small flowering head.

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upland hay should be used for horses doing fast work Lowland hay is inferior. Water meadow hay is altogether unfit for horses. These terms, which are in common use and generally well understood, are not in all cases strictly accurate, viz., a low-lying meadow may repose on a dry foundation, and in addition may be well drained, and if so, it may grow fine, commonly called upland grasses. On the other hand, a meadow may lie high and yet be a swamp, and will therefore grow coarse, commonly called lowland or even water meadow grasses. Still for all practical purposes, these expressions may be used, and will be understood by all practical men. Certain grasses grow only on upland meadows, others only on lowland, whilst others are found only on water meadows. Some sorts are found both in upland and lowland meadows, whilst others are found both in lowland and water meadows. In short, no very sharp line of demarcation can be drawn between grasses of upland and lowland and water meadow growth. They shade into each other according to the peculiarities of the soil. The best upland grasses will, however, be found only in upland meadows, but the inferior upland grasses will be found in moderately dry lowland meadows, and *vice versâ*; the best sorts of lowland grasses may be found to a certain extent in upland meadows. The same remarks apply to lowland and water meadow grasses. The inferior lowland grasses may be found in water meadows, whilst the best water meadow grasses may occasionally, though more rarely, be found in lowland meadows.

3rd. Time at which the hay has been cut. It has been proved both by experience and by chemical analysis that for hay-making purposes, grass is best when cut in flower, and before the falling of the seeds. Considerable chemical changes take place in the composition of the grass as it ripens, and the amount of nutritive value contained in it becomes less. Not only is the quality of the hay better if the grass is cut shortly after it attains its full height, and whilst still flowering, but the crop is actually heavier and the land is less exhausted than if the grass had been allowed to "seed." Therefore, in examining hay, this point should be carefully noted. Hay may be composed of the best grasses, and be well saved, and from good soil, yet it may be worthless, owing to the grass having been allowed to seed before being cut.

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4th. The way in which the hay has been saved. In hay making the chief point to be observed is that the grass once cut should remain on the ground as short a time as possible. If left too long in the sun it loses colour and flavour, and becomes dried up. If exposed to rain much of its nutritive qualities are washed out of it. Hay should never be turned in wet weather as it not only becomes bruised but a fresh surface is exposed to the unfavourable action of the rain. The time required for drying varies according to the juiciness of the grass, but the hay should, if possible, be carried on the third or fourth day.

Various conditions of hay arise from its being "badly saved," all of them affecting its nutritive value, and some of them causing its consumption to be highly injurious:—

Weather-beaten Hay.

The damage from exposure to weather may be only slight, such as results from a shower of rain, causing a slight loss of colour and aroma, or the hay may be bleached and sapless or as it is called "washed out." In this state it is worthless.

Dusty Hay.

Dust in hay may be caused by exposure to weather, by the hay being quickly dried in a hot sun after a shower of rain, or by blight. If very dusty, hay should be rejected.

Musty Hay.

Mustiness is caused by the hay having been exposed to wet or damp, and not sufficiently dried before being stacked. It has a distinctly musty smell which is easily recognizable, and such hay should be rejected.

Mouldy Hay.

Hay that is mouldy is in an advanced stage of mustiness, and this state arises from the same causes. Fungi are plentiful in it. The colour is dark, and the taste bitter. It is unfit for horses. Sometimes a few mouldy spots may be seen in a truss of otherwise good hay. If these are small and few, they can be picked out and do not affect the quality of the remainder of the truss. Sometimes a bit of horse

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White or Dutch Clover
(Trifolium repens.)

Red Clover
(Trifolium pratense)

Little Yellow Clover
(Lotus corniculatus)

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HERBAGE.

Little Yellow Vetch.
(Lathyrus pratensis.)

Sain foin.
(Hedysarum. Onobrychis.)

Hop Trefoil.
(Trifolium procumbens)

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Plate XI.
WEEDS.

To face p. 66.

Common Bank Sedge
(Carex riparia.)

Small Sedge.

Wood Rush
(Luzula campestris.)

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Plate XII

WEEDS.

Cats ear in flower
(Hypochæris radicata)

N.B. In Hay this weed shrivels greatly, and the stalks become a mere thread.

Coltsfo
(Tus

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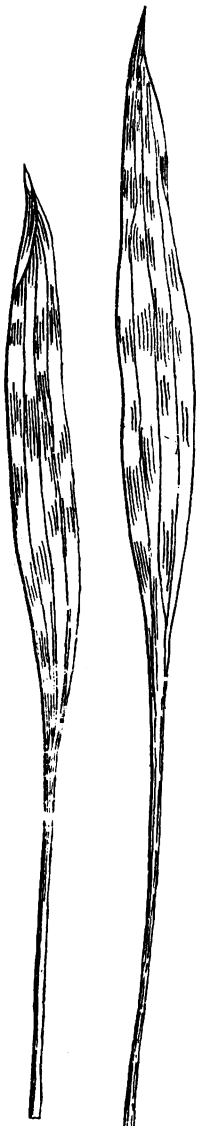
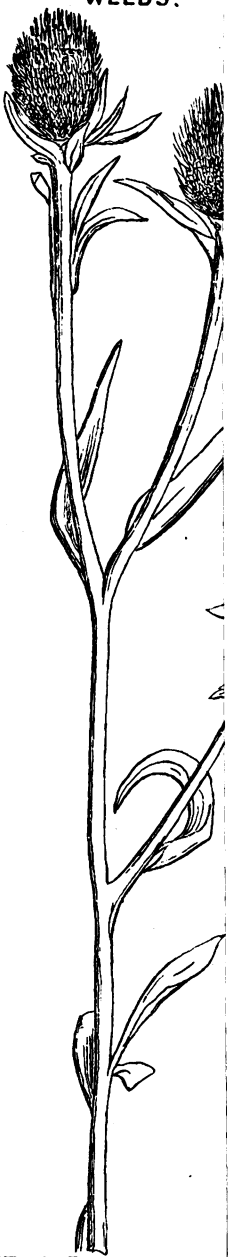
Plate XIII.
WEEDS.



Rib Plantain
(Plantago lanceolata)



Hard or Blackhead or Kn
(Centaurea nigra.)

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dung gets into the stack and causes a small patch of hay around it to become mouldy.

Mow-burnt Hay.

A certain amount of fermentation in a stack of hay is necessary to develop its nutritive qualities. When this fermentation is excessive owing to the hay being carried too soon, before the sap was sufficiently dried, the hay is said to be mow-burnt. Mow-burnt hay is very dark in colour, has a strong smell of liquorice and a pungent taste. If only slightly mow-burnt, horses are fond of it as it contains a large quantity of sugar, but if badly affected, it is highly injurious, and horses should not be allowed to eat it as it acts powerfully on the kidneys and digestive organs.

Characteristics of Good Hay.

It will be seen from the foregoing that hay to be good, must be composed of the best grasses and herbage, must be grown on good and suitable soil, must have been cut when the grasses were in flower and before they had seeded, and must be well saved and very little heating must have taken place. It must also be from the first cutting of the year. In wet seasons the quality of the hay is always inferior. The farmers often delay cutting until the grass has seeded, in hopes of better weather, and the hay is generally badly saved, either much weather-beaten and washed out or else mouldy or musty. In very dry seasons, the crop will be lighter and the texture of the hay will be finer than if there had been abundance of rain to promote the growth of the grass.

In exceptionally favourable seasons, such as 1889, when the spring was mild, with plenty of rain, the hay season for harvesting, dry and hot, the crop was very heavy, and in most cases well saved. But in some instances, farmers were in such a hurry to carry the hay for fear the weather would change, that a considerable amount of hay was either mow-burnt or entirely lost from heating in the stack, and catching fire by spontaneous combustion. In judging hay, therefore, the characteristics of the season must be taken into consideration. In unfavourable seasons it is naturally impossible to obtain such good hay as in favourable seasons.

Briefly, the characteristics of the best old pasture or meadow hay, are cleanness, firmness, crispness, and green

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colour, delicacy in taste, aroma and appearance, abundance of flowering heads of the best grasses, the presence of flowers in their natural colour with sweet vernal and other early grasses in flower, and the fibres lying mostly in one direction.

Brightness of colour is an essential requisite as regards market value, but many samples of inferior colour possess no other actual inferiority. Hay is at its best at one year old. It is not improved by keeping for three or four years. New hay is unsuited for feeding horses. A proportion of herbage is desirable. The different varieties of clover, especially White or Dutch and the trefoils, constitute the great mass of good upland herbage. These plants are generally abundant where the soil on which the crop is grown is good. Hay composed only of the best grasses is not relished so well as when mixed with a proportion of herbage. A mixture of weeds in hay is objectionable. The presence of flowers which have not lost their colour, such as buttercups and the flowers of trefoil and clover, is always an item of value in hay, as it shows that the crop has been cut early in the season before the grasses have lost their juices and nutriment. A similar favourable indication is given by certain early grasses such as sweet vernal being still in flower, *i.e.*, not run to seed.

The above characteristics refer principally to "old pasture" hay, that is hay grown on land which has been "laid down" for some years in grass. At present the cultivation of grass for hay-making purposes enters largely into the "rotation of crops." Land which will not carry good grasses, if laid down in grass for a lengthened period, will, when tilled, manured, and sown with grass seed yield two or sometimes three heavy crops of hay in the season. Grass grown in this way is termed "artificial grass" or "force grass," and in some localities the term "upland" is applied to this class of hay only. Various mixtures are recommended for this purpose, but the most usual perhaps is rye-grass and one of the varieties of clover. The grass which grows from this seed on the 1st year it is sown is known as "1st Crop," and from this crop there may be two or three cuttings, usually two, and the third growth is fed on by sheep. The hay made from the first cutting is best. The second cutting contains more clover and less rye-grass in proportion, as rye-grass does not grow well a second time. The growth of the

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second year is known as "2nd Crop." This is generally finer in texture than first crop and not so succulent, but when made into hay is perhaps better suited to horses doing fast work than first crop. Thus we speak of "1st Cut," "2nd Crop," or "1st Cut," "1st Crop." These two terms cut and crop, must not be confounded, the crop signifying the year, the cut, the number of times the grass has been cut during the year.

Hay grown in this manner is well-suited for feeding horses. The land being cleaned and manured when the seed is sown, the hay contains little or no admixture of inferior grasses or weeds. The chief objection to this class of hay is the difficulty of "saving" artificial grasses such as Clovers, Sainfoin, &c., properly, owing to their succulence and the large quantity of water contained in them. This often causes the hay made from them to lose colour and to become dusty, musty, or even mouldy. When clover and rye-grass are sown together the difficulty of saving the hay is increased, the rye becoming dry and ready for carrying much more quickly than the clover.

Clover hay commands a high price in the London Market, often fetching as much as £7 per ton. Veterinary authorities recommend that hay made from artificial grasses should be mixed with old pasture hay in the proportion of $\frac{1}{3}$ of the former to $\frac{2}{3}$ of the latter. Broken wind and diseases of the air passages have been attributed to an undue allowance of clover. Vetches in large quantities have been said to produce stomach staggers.

This class of hay is sometimes known as "hard" hay in contradistinction to old pasture hay, which is known as "soft" hay. In the neighbourhood of Aldershot, hay containing rye-grass is termed "benty hay." Many Commanding Officers of Cavalry and Horse Artillery prefer either entirely or a preponderating quantity of "soft" hay for their horses. Other branches of the Service whose horses do slower work prefer "hard" hay as a rule.

The characteristics of good "hard" hay are strength and stoutness of the stalks, absence of grass leaves, abundance of flowering heads of rye-grass, and of whatever other artificial grasses the mixture is composed. The leaves and flowers of the clover, &c., should retain their natural colour. There is on it an appearance of golden bloom, and the hay should not be dusty, musty, or mouldy. The aroma of new-

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mown grass found in old pasture hay is wanting in this class of hay, unless the mixture contains sweet vernal.

Aftermath, or second cut, is an unseasonable production. It is good for feeding cattle but is unsuited to horses. Its characteristics are softness, absence of flowering heads and breadth of leaves of the grasses and absence of aroma.

Orchard, or park hay, is hay grown under trees. Its characteristics are similar to aftermath.

Lowland hay is that grown on badly drained land. Its characteristics are softness, dark colour, absence of aroma, breadth of leaves, presence of bad grasses and weeds, and absence of the best grasses and herbage. Rushes and rattle are often abundant in hay of this class.

Water meadow hay is rank and coarse. It is composed chiefly of ribbon grass, reed sweet grass, and tufted hair grass. Sedge, rushes, and other water plants are abundant. The colour is dark, the taste strong and bitter, and the aroma of good hay is quite wanting.

The above classes of hay are quite unfit for horses, and are excluded by the terms of contract which stipulate for upland hay.

Distinction between New and old Hay.

The contract stipulates that new hay shall not be supplied until 1st October, and a great deal of trouble is caused by contractors trying to pass in new hay during the month of September. The supply of good old hay is then becoming scarce and dear, and the difficulty of distinguishing between new and old hay is so great that the temptation to breach of contract in this respect is very strong.

New hay is most injurious, is difficult of digestion, and produces purging. The only certain way to distinguish between new and old hay is to weigh a certain amount carefully; dry it in an oven at a temperature of 212° F. until it ceases to lose weight. The loss in weight is the moisture contained in it. In new hay this is not less than 16 per cent., in old hay not more than 14 per cent. There are various guides for determining the age of hay, but they are so liable to variation according to the season, the way in which the hay has been saved, the amount of fermentation and consolidation that has taken place in the stack, &c., that they are not much to be depended on.

Certain weeds are supposed to furnish indications as to the

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age of hay. The leaves of rib plantain, colt's-foot, silver weed, and dock, retain their green colour and flexibility for three months; after three months they lose their green colour but retain their flexibility up to six months; after six months they become black and brittle. In the black head, sap is found in the stalks up to three months, in the knots up to six months, and in the heads only up to nine months, after which time they become dried up. The feel, too, of new hay is quite different from old hay of the same class; it feels softer and damper. It requires a little practice to become master of this "feel," but once learnt it is never forgotten. The taste, too, of new hay is very different from old hay. Put some of the stems in the mouth, and in new hay the taste is much more sugary than in old hay. All these indications, however, vary with the season and the amount of fermentation to which the hay has been subjected. Dealers judge of the age of hay chiefly by the peculiarities of each season's crop, whether it is light or heavy, well or badly saved, &c., and perhaps these peculiarities furnish the most reliable guides, if the area from which the supply of hay is derived is limited.

Purchasing Hay direct from Farmers.

Hay is usually obtained by contract, but the system of purchasing in the stack direct from farmers has recently been tried with some success in the neighbourhood of Aldershot. It is necessary that great care be exercised in inspecting the stacks as the hay (with the exception of trusses faulty in condition) becomes the property of the Government on conclusion of the purchase, and, if subsequently found of bad quality on inspection, when delivered at the forage barns, great loss may be incurred in disposing of it.

According to the orders given, either the officers inspecting the stack buy outright or they bring back samples with information as to price, and from these the purchase is completed by the General Officer Commanding. In the former case, an officer of the Army Service Corps, accompanied by a cavalry or artillery officer, visit the farmers and ascertain what hay they have for sale. They should have a "hay testing spear," and should draw out samples from several parts of the stacks to see that the hay has not heated too much, care being taken to do this on the leeward side of the stack, as more heating will have taken place there. Should the

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hay be found of good quality and well saved, the purchasing officers should, if possible, see the fields on which it has been grown and satisfy themselves as to the quality of the land. Then a sample from each stack should be taken and a rough sketch of the "rick yard" made, showing the stacks which have been selected, the points of the compass being marked on the sketch in order to assist in identifying the stacks when delivery is made. In the case of these officers having authority to purchase outright, a limit as regards price will be given them by the Staff Officer concerned, and every effort should be made to obtain the hay as much under this limit as possible, taking into consideration the quality of the hay and the distance from the forage barns. The hay is bought by the ton or in whatever weight is usual in the locality, the price fixed to include delivery at certain specified forage barns. Should delivery be taken at the nearest railway station, a sum sufficient to cover cartage from the station to the barns must be deducted. The purchasing officers should make themselves acquainted with the railway carriage rates between the stations in the neighbourhood where hay is to be purchased, and the station at which delivery is to be taken. The hay is usually delivered in trusses of 56 lb. (if before the 1st October, 60 lb.). The cost of cutting out and tying varies from 3*s.* to 4*s.* per ton.

The hay being purchased by the ton or other specified weight and weighed on delivery, it is only necessary to form an approximate estimate of the contents of the stack and the farmer's word may generally be taken for this.

More advantageous terms, could, however, be obtained were the stacks purchased as they stand, and should this be done, it is of course important that a correct estimate of the contents be made. Long experience is necessary to do this, farmers and dealers often being at fault and consequently officers should be very chary of buying in this way unless very experienced and confident of their judgment. The cubical contents furnish an uncertain guide, as so much depends on the amount of consolidation that has taken place. However, length × breadth × (height from ground to eaves + one-third the height from eaves to top) all in feet, divided by 320 (the number of cubic feet in a ton of average hay), will give the tonnage in a stack roughly.

Another way is to pace the length and breadth in yards. Then as a truss of hay measures 3 feet by $1\frac{1}{2}$ feet (the depth depending on the amount of consolidation), the number of

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trusses in the bottom of the stack can be determined. Judging by the class of hay—artificially grown hay weighing more than old pasture hay—and to what extent the hay has consolidated, a guess may be made at the number of trusses that will reach to half way up the eaves, and this number multiplied by the number of trusses in the bottom will give the total number of trusses in the stack. There are forty trusses in a ton, so that the number of tons is easily determined.

The dealer's method is to make a guess at the contents, which from long experience he is able to do pretty accurately. Should the farmer consider that the stack contains more than the dealer thinks, he purchases by the ton, sending his own men to cut out; but should the farmer's estimate of the contents be lower than the dealer's, the latter buys the stack outright at the farmer's estimate. If one can ascertain the number of acres of grass in a stack it may be useful, as with a little experience one can tell from the class of hay the probable weight to the acre, usually from $1\frac{1}{2}$ to $2\frac{1}{2}$ tons. The price having been agreed on, the farmer signs a tender which is forwarded to the Staff Officer, and if accepted, quarter of the value of the hay is at once paid to the farmer, the stacks being insured against fire at the farmer's expense, and the remainder is paid on the delivery of the hay. The price of hay varies with the season and with the quality from £2 10*s.* to £5 10*s.* per ton.

Chaff or Chopped Hay.

Greedy horses bolt their corn, and in this way the corn, not being properly masticated, yields little nourishment. By mixing chaff with the corn, the horse is compelled to chew his food. This chaff is usually composed of equal portions of hay and wheaten or oaten straw chopped into small pieces of a quarter to half inch in length. Ready cut chaff should not be bought, as such chaff usually consists of damaged hay and straw, totally unfit for food, which, by being salted and mixed with the corn, the horse is induced to eat.

Trade Usages.

In London, and for a distance of 25 miles round, hay is generally bought by the load of 18 cwt. or 36 trusses of 56 lb. each. New hay, if sold before the 30th September, must weigh 19 cwt. 1 qr. 4 lb., or 36 trusses, weighing 60 lb. each truss. In the country districts, hay is generally bought and sold by the ton of 20 cwt. or 40 trusses, weighing 56

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lb. each truss. The price of a load varies in different seasons, the average for 1889 crop was from £3 10*s.* to £4 10*s.* for good upland hay.

Weight of Hay and Straw.

The weight of hay per cubic yard varies very much according to its age, thus:—

1 cubic yard new hay, weighs	...	...	84 lbs.
,, old ,, ,,	...	...	126 ,,
,, well pressed old hay	...	220 ,,
,, ,, ,, straw	...	145 ,,

Stacks and their Contents.—Hay is usually found in stacks, as in fig. 1, straw as in fig. 2. The volume of fig. 1 is given by the formula.

$$\left(A F + \frac{D E}{3}\right) \times A C \times A B.*$$

The volume of fig. 2 (in which A B, B C, and E D, are supposed to be equal) may be roughly taken as equal to a cylinder on the same base, and of equal height, and its volume would be found by multiplying half the radius of the base by the circumference, and the product by the height of the stack.

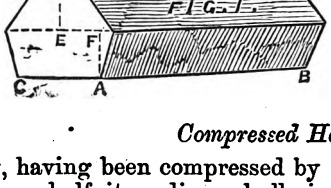

FIG. 1.

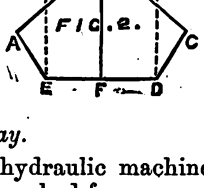

FIG. 2.

Compressed Hay.

Hay, having been compressed by hydraulic machinery to about one-half its ordinary bulk, is packed for use on board ship, or on active service, in bales of various sizes. These bales are bound with iron hoops. Hay intended for pressing must be good, sweet, well-saved meadow hay of upland growth, containing but little moisture and at least four months old. Clover or other coarse hay is unsuitable. Compressed hay may be kept for four years without deterioration, as was proved

* This formula allows for make weight.

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experimentally at Aldershot in March, 1888. The present hay presses press a ton to 120 cubic feet. New ones being constructed will press a ton to 90 cubic feet, in bales of 80 lb.

Compressed Fodder.

Compressed fodder has the advantage of being very portable and of being of greater nutritive value than oats, 9 lb. of fodder being equal to 10 lb. of oats. It is made in cakes, 3 of them being packed in a bale weighing from 75 lb. to 81 lb., according to the maker's custom. Each bale is protected by a canvas cover bound with iron hoops and should be marked with its weight. One ton measures about 55 cubic feet. Before using, this forage should be moistened with water, thereby replacing the moisture extracted during packing. The price is about £10 15*s.* a ton. The cubical contents of one bale is about $2\frac{1}{4}$ cubic feet.

Moss Litter.

Moss litter, obtained from the surface layer of turf bogs, is sometimes used as bedding in lieu of straw. It is usually supplied in iron-bound bales of about 3 cwts. It does not appear to have any great advantages over straw, whilst on the other hand it possesses some disadvantages.

Three kinds of moss litter have been tried for Army Service—English, Irish, and German. It is considered that the English moss litter is equal to the German, but that the Irish is of somewhat inferior quality.

The advantages and disadvantages of moss litter may be summed up as follows :—

Advantages.

1. It is very good for severe cases of lameness where the horse must lie down.
2. It does not get lumpy.
3. It is soft to lie upon.
4. If it is properly used no drains are required. The soiled portions must, however, be removed and renewed.
5. It is economical in dry weather.

Disadvantages.

1. It is cold and damp in winter.
2. It rots the horse's frog and causes thrush.
3. If the groom is careless, the soiled portions quickly contaminate the lot.

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Moss litter for horses is supplied in Ireland at about 35*s.* a ton, to which has to be added the cost of carriage. The quantity allowed per stall is 56 lb. at first and a weekly issue of 28 lb. per stall afterwards. This, however, has been reported to be insufficient, and 1 cwt. to commence with and 1½ cwt. per month afterwards was recommended.

Green Forage.

The term green forage comprises clover, sainfoin, lucerne, rye-grass, tares, or vetches, green oats, carrots, parsnips, &c. Horses are fond of it, and will eat it greedily in large quantities, and at times without sufficient mastication. It is then apt, especially if the grass is wet, to ferment in their stomach and distend it to a great size, thereby causing the disease so common among, and so dangerous to cattle, called "swelling" or "hoving." It should, therefore, invariably be given cautiously and in small quantities at a time.

Green forage should always be young and fresh, but should never be cut when wet with rain or dew, as dampness causes excess of fermentation to take place in the horse's stomach. If stale and old it loses much of its succulence, becomes heating, and from rapid decomposition, is apt to produce colic and intestinal disease. The best green forage consists of clover, sainfoin, and lucerne, as they are the most nourishing and fattening kinds of grasses, and are much relished by horses. If these cannot be obtained, rye-grass, tares, or vetches, or ordinary grass may be given.

Grasses are in their prime when in full bloom. Tares or vetches, however, should be given when the seed is nearly ripe, they are then nearly as stimulating as corn, whilst if eaten when young, they are very relaxing and act powerfully on the kidneys. Green oats should not be given if any of the aforementioned grasses can be obtained.

Carrots and parsnips are the only roots which are readily eaten by horses. They have at first a slightly aperient and diuretic effect, and then serve to cool the system and fatten the horse, four lb. of carrots are equal in nourishment to one lb. of oats, but they do not possess the same amount of muscle-making material, and like green fodder are only suited for horses employed at easy and slow work. Horses will not readily eat mangold wurzels or turnips.

Carrots should be washed and either sliced or grated up.

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Horses are so greedy after them that unless this precaution is adopted they are liable to be choked.

Straw.

Straw must be either wheaten, oaten, or rye, and should be clean, dry, and not much broken in the thrashing. Steam thrashed straw is inferior to that thrashed by manual labour, inasmuch as it is more broken.

Wheaten is generally preferred to oaten straw, and certainly looks nicer in the stable; but there is no real objection to the latter, except that when new, horses are apt to eat it. This, however, may be prevented by a proper arrangement of the bedding. Rye straw is very good, but in most localities its price is a bar to its use.

Barley straw is inadmissible. It is apt to induce disease of the skin.

Straw should be clean, bright in colour, sweet, and dry. It should have no musty smell. It should be selected for its length, and the size and stoutness of its stalks.

Bran.

Bran is a very important article, having a cooling effect from its laxative properties when made into a mash with water. It acts on the lining membrane of the stomach by causing a slight irritation, which increases the secretions, and it thereby acts as an aperient.

Dry bran is often given with sliced carrots, with which it makes an excellent food for slow working horses, but there is not any great amount of nourishment in it by itself.

Dry bran is said to have an astringent effect, and is sometimes given after physic if over active, to stop its further action.

Bran mash is made either hot or cold. In either case a bucket is half filled with the bran, and then as much water as it will absorb is poured upon it, and if hot it is put by till nearly cold, being closely covered up in the meanwhile.

Troop horses are usually given a bran mash, in lieu of a feed of oats, every Saturday evening, partly because the horses are not exercised on Sundays, and partly as a preventative to constipation, which might otherwise arise from the horses being kept on hard food exclusively year after year, and might necessitate the use of medicine.

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When the grains of corn have been deprived of their outer husks, they are ground in a mill, and the meal thus produced is then passed through a dresser, which separates the flour from the skin layers of the grain, which are called bran, and consist practically of the refuse of the dresser.

Wheat bran only is admissible. That obtained from hard or red wheat is preferable to that from soft or white wheat, which is less nutritious. It should be coarse, fine bran is only fit for feeding pigs. When handled it should leave traces of flour on the hands. It should be perfectly fresh ground, sweet, dry, of a yellowish tint and odourless.

Fine bran is frequently mixed with coarse, the particles of good bran should therefore be not only coarse, but uniform in size. In the process of dressing flour the fine bran is separated from the coarse, and they should not afterwards be mixed together.

Millers frequently not only mix the fine bran with the coarse, but also add to these a part of the refuse from the winnowing machines. The refuse used for this purpose consists of particles of straw and chips from the outer husks of the corn, which are separated from the grain before it is ground, and which are altogether devoid of nutriment. There is no difficulty in detecting the admixture, which should cause the bran to be rejected.

Other adulterations are sawdust and sand. The latter can be readily detected by putting some of the bran in water when the sand falls to the bottom.

Oats.

Of grain for the horse, long experience has proved oats to be the best.

Varieties.—The following are the principal varieties:—

(1.) The white or common oat, known by its white knot and kernel.

(2.) The black oat.

(3.) The red oat, known by its brownish red husk, thinner and more flexible stem and firmly attached grain.

(4.) The Poland oat, known by its thick white husk, awnless chaff, solitary grains, short white kernel, and short stiff straw. This is an excellent variety, weighing sometimes 48 lb. to the bushel.

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(5.) The Friezland or Dutch oat has plump, thin-skinned, white grains, mostly double, and the large ones sometimes awned—sometimes called Winter oats.

(6.) The potato oat has large, plump, rather thick-skinned, white grains, double and treble, with longer straw than either of the last two named. It is usually the highest priced variety.

Characteristics of Good Oats.

Good oats are clean, hard, dry, sweet, heavy, plump, full of flour, and rattle like shot. They have a clean and almost metallic lustre. Each oat in a well grown sample is nearly of the same size. There are but few small or imperfect grains. The hard pressure of the nail on an oat should leave little or no mark. The kernel when pressed between the teeth should chip rather than tear. The skin should be thin. The size of the kernel will be less in proportion as the skin is thick. The colour of the oat is not very material, but white oats are generally thinner in the skin than black.

Short plump oats are preferable to large long grains. Bearded oats must have an excess of husk. Oats are not necessarily bad because they are thick-skinned or bearded; but they must contain a less amount of flour per bushel than thin-skinned oats without beards.

Good oats are without smell of any kind, except that of earth in new samples. The flour should be almost tasteless, except a slight sense of milky sweetness to the palate. In tasting oats the purchaser should put a considerable number into his mouth without looking at them, in order to get a fair average of the grains. If he selects one or two oats to taste, he is sure to choose good grains.

Oats should be about one year old when required for use.

Weight of Good and Bad Oats.

Good oats weigh about 42 lb. per bushel. Very good samples reach 44 or 45 lb., and from a few districts, oats as high as 48 or even 49 lb. may be obtained in favourable seasons. Fair marketable oats weigh about 39 lb. The Government contract for oats stipulates for a weight of 38 lb. per bushel. Very inferior ones do not weigh above 32 lb.

Very dirty oats sometimes, on account of the dirt and sand

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in them, weigh better before than after they have been cleaned; but as a general rule the effect of cleaning and winnowing a sample is to make it weigh more per bushel. The principal part of the refuse which is thrown out consists of husks and of small, imperfect, or mouldy grains, which are very light in proportion to bulk.

Good oats, even at a high figure, are cheaper for feeding purposes than inferior samples at a lower price. The increase in weight per bushel is mainly in flour. The husk forms a much larger proportion in light than in heavy oats.

Dealers often offer to make up the weight of a lot of oats to the stipulated number of pounds per bushel by giving an increased quantity. This practice should not be permitted. Good oats yield more flour per lb. than inferior oats, besides which the flour in light oats is always inferior in quality to that contained in well-grown, fully ripened, and well-developed oats.

Experiments go to show that in fair samples of oats those weighing

32 lb.	gave	19 lb.	15	oz.	meal.
38	,,	26 ,,	7		,,
42	,,	30 ,,	14		,,
44	,,	33 ,,	14		,,

Mode of Weighing a Bushel.

In buying oats it is customary to stipulate that the lot shall weigh so many pounds per bushel. In weighing them for this purpose it is of course the object of the seller to get as many oats as possible into the measure, and thus to increase the apparent weight of the sample per bushel; whilst the object of the buyer is to make them weigh as light as he can, or in other words fill the measure with the least possible quantity of grain.

Tricks are often played on the unwary and sundry devices are adopted, such as moving the measure once or twice while it is being filled, or shaking it, or knocking against it with the scoop in pouring in the grain, or heaping it over-full, and pressing down the grain when it is "struck." The effect of these devices is to cause the oats to lie close together, and thus to make the measure hold more than it otherwise would.

But apart from such tricks, a very considerable difference

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may be produced in the apparent weight of oats according to the way in which the measure is filled.

In the wholesale trade at the large riverside granaries the oats are run through a shoot into the measure. This gives the true, otherwise called the "natural" or "trade" weight. The measure so filled holds the least possible quantity.

In the retail trade some other methods are commonly used. The following are the results of weighing a bushel of oats, of which the natural or trade weight was 38 lb. Filled quickly from a large shovel and the strike applied at once, the measure held 38½ lb. The success of the operation depends on the measure being placed on a firm basis, so that it will not move or shake, and on its being filled quickly. The oats then have not time to run together and consolidate. The measure in consequence holds almost the least possible quantity. The stick used for striking should be, as ordered by Act of Parliament, round, not flat, and should be about 2 inches in diameter and 2 feet 4 inches in length, so as to allow of a fair grasp on both sides of the bushel measure. It should be applied as soon as the measure is filled, so as to allow no time for the consolidation of the oats.

If the measure is shaky, or if through clumsiness or intentionally the shovel is allowed to knock against or even to lean on the measure, the result will be that it will hold more grain than it ought. A similar result will follow if the measure is filled slowly.

Filled from the mouth of the sack by allowing the oats to run in freely and quickly the measure held nearly 38¾ lb., when the operation was neatly and well managed. There is a good deal of knack in getting the oats to run out freely. The mouth of the sack must be opened wide, and the sides should be well turned down, so that no interruption may occur in filling the measure. Care must be taken that the mouth of the sack does not touch the measure. With this view the sack should be placed on a raised platform. The footbard of the scales will answer for this purpose.

But when the operation was clumsily performed, and the measure was shaken or moved by the pressure of the sack, it held 39½ lb.

Filled by pushing the measure into the heap and turning it up without shaking, and filling up the deficiency quickly with the scoop, the measure held 38¾ lb. If clumsily managed 39½ lb.

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Filled very quickly from a small scoop, the measure held 39 lb. Filled somewhat slowly from the same scoop 39½ lb.

Filled from a shovel held at the hip, the grain being allowed to flow or trickle in slowly, the measure held 42 lb., or in other words the sample was made to appear to weigh 42 lb. instead of 38 lb., the natural or trade weight. Here both the height from which the grains fell and the slowness of the operation combined in causing consolidation.

Different samples no doubt will give somewhat varying results, according to the greater or less tendency which they may possess for consolidating; but from these details the intending purchaser will readily see that, in order to get the article he contracts and pays for, it is necessary that he should know how to weigh a bushel.

In addition, however, to knowing how to do it, there is a good deal of knack and practice required to fill the bushel properly; and the reader, if he tries the above experiments for himself will probably at first fail to get the true weight.

To determine the correct weight of oats, it is necessary that a uniform quantity of oats should fall from a uniform height at a uniform speed, and with a uniform pressure into the bushel measure.

A small instrument called a chondrometer is used to ascertain the bushel weight of oats and other grains by weighing a small sample. It is very handy for office use as a large envelope filled with grain is sufficient.

Even, however, with the proper mode of weighing, tricks are sometimes played by dishonest dealers, which affect and increase the weight of a sample. If a sample, for instance, before going to market receives a good shaking, the friction thereby caused will rub off a good many of the awns and asperities of the husks, and the seeds will then flow in more easily into a compact mass, and thus the weight per bushel will be increased; whilst the remainder of the lot, which have not been subjected to the same friction as the sample, will not yield the weight supposed.

Again, certain descriptions of oats give, if we may use the expression, deceptively good weight. Very smooth and well-closed oats, for instance, lie closely together, and leave but little space unoccupied, and therefore, though they may contain but little flour, may still weigh fairly well. Another sort with really better filled grains, but with rougher coats, may weigh less. Again, some very good-

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looking smooth large foreign oats give a great weight per bushel on account of the almost woody nature of their husks. Lastly, damp oats, which have not been damp sufficiently long to cause them to swell, may give an unfairly good weight.

The purchaser, therefore, whilst relying on weight as one great, and in most cases, the best test, must take care to note well all the other characteristics of the lot he proposes to buy.

Various Defects in Oats.

Kiln-drying is a process resorted to in order to get rid either of dampness or softness, or of both defects. Oats so dried have a peculiar and easily recognised smell and taste, and in some cases there is a loose and shrivelled appearance about the ends of the husks. This arises from the kernel having swollen when damp, and afterwards contracted in size, when the damp was suddenly expelled in the kiln. The colour of the oat is also deepened, and often assumes a reddish hue; but the colour, as will be explained presently, may be got rid of by fumigation.

The process of kiln-drying in itself damages the flour to a certain degree; but the great objection to kiln-dried oats arises from the flour having been in most instances (as regards English oats) damaged before they are sent to the kiln. No amount of drying will restore damaged flour to its original condition, or, in fact, make bad into good flour. An attempt is often made to get rid of the smell by spreading out the oats in thin layers to the action of the air, and then mixing them with new fresh-smelling oats immediately before they are offered for sale. Foreign oats, even though in good condition, are nearly always slightly kiln-dried before being put on board of ship, to prevent their heating in bulk during the voyage. This process, if the oats are in good condition, as they often are in the finer climates of the Continent, is almost unobjectionable. Oats, which have been badly saved, or have become dirty from any cause, are sometimes washed to improve their colour, and are then put in the kiln to be dried. Very good new oats are occasionally slightly kiln-dried to harden them and make them resemble old oats, and thus increase their value. The effect of kiln-

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drying is to drive away about 5 per cent. of moisture, thus saving in carriage 1 cwt. of water in every ton.

Foxy oats are those which have heated from being kept in bulk, when not perfectly dry; and in consequence have undergone to a certain degree a process of fermentation. They are easily recognised by a reddish and sometimes very red colour, and by a peculiar bitterness of smell and taste. They are unfit for horses. The nutritive quality of the flour is in a great measure destroyed. They act injuriously, especially on the kidneys, and produce excessive staling, and cause the horse rapidly to lose condition. The red colour is sometimes got rid of by fumigation.

They resemble kiln-dried oats, but are hard internally, whereas kiln-dried oats (if originally damaged) are powdery.

Fumigation or *bleaching* is a process resorted to in order to get rid of the heightened colour imparted to the oats by the process of kiln-drying or by their having become foxy.

The dark colour is got rid of, and an unnaturally white hue is given by subjecting the oats to the fumes of sulphur. This fraud may be detected by taking a handful of oats from the heap, and bringing it quickly up to the nose, or by applying the nose directly to a hollow made in the heap. When, however, the process is well managed, the smell is exceedingly faint.

Damp oats are objectionable, and should not be taken. Dampness, however, is in some measure a question of degree and of the length of time during which it has existed. Continued damp, especially when the oats are stored in bulk, soon produce softness, mustiness, mouldiness, or sprouting.

Softness is the first effect produced by damp. The flour, though not in perfectly good condition, may still be wholesome, but any such defect militates against good, hard condition in the horse.

Mustiness is a further stage resulting from damp. Musty oats are easily recognised by the smell. They are altogether unfit for food, and are sometimes poisonous, being in an incipient state of decomposition. When examined under the microscope, a fungoid growth may be detected on the inner growth.

Mouldy oats are in a state of positive decomposition, and are obviously unfit for food.

Sprouting is a process of new growth or germination in the oat, induced by damp combined with some amount of warmth

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under certain conditions of the weather. In this respect it will be seen that sprouting differs from mustiness or mouldiness, which are processes of decomposition and death of the grain. Oats which have sprouted are quite unfit for food.

Other defects in oats are dirt, stones, and want of proper winnowing. These defects, though they militate against the value, may be remedied by screening and winnowing.

Distinction between Old and New Oats.

The chief distinction between new and old oats lies in the smell. New oats smell fresh and of the earth. There is a decided earthy smell about them, which is lost in the old oat. Old oats, if newly thrashed out, may smell fresh, but there is not the earthy smell about them. As a rule, however, they smell rather musty and frequently of rats.

In new oats the outside of the husks in well-saved samples is bright and shining, having almost a glazed appearance, especially in the black variety. In old oats this glazing is lost. The outside, though it may be perfectly clean, is dim, and the ends of the husks in white oats, and the point of the kernel in both white and black oats are nearly always a little darkened. Badly saved new oats may in these respects sometimes resemble old oats; but in such cases they will probably be distinguished by their softness.

The taste of the new oat is fresh and milky; and its flour, when moistened in the mouth, readily adheres together. The taste of the old is slightly bitter. In the mouth the flour feels dry, and is not easily moistened. In the new oat there is a certain degree of juiciness, sweetness, and milkiness about the flour. In very dry seasons these distinctions are less observable than in ordinary years.

New oats, as a general rule, are softer than old; but here again the season, the state of the weather for some time preceding the sample coming to market, and the dampness perhaps of the place in which they have been stored, may cause old oats to handle as soft as new. On the other hand, in very fine seasons new oats may come to market almost as dry and hard as old in average years.

In bearded varieties the beards are well preserved in new samples; but from old oats a considerable proportion of the beards have fallen off or been knocked off by friction in carriage, &c. In all kinds the ends of the grains from the

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above causes always look shorter and sharper in old than in new samples. The husk also becomes tight, and locked round the kernel.

The skin of the kernel of a new oat is covered with a very fine prickly down, composed of very minute hairs. In the old oat the kernel appears and feels very smooth. If the husks are stripped off, this distinction will be quite perceptible to the palate in chewing a few grains of each.

All the above distinctions except the first are subject to so many modifications, according to varying circumstances, that we must advise the reader, whilst not altogether neglecting them, to form his opinion chiefly by the presence or absence of the earthy smell.

An ordinary sample of old oats contains 12 per cent. of hygroscopic moisture, whereas new oats will contain 15 per cent.

The average crop of oats is about 42 bushels, and the straw from 2 to $3\frac{1}{2}$ loads per acre. The produce of oats in meal amounts to 8 lb. for 14 lb. of corn.

Kibbled Oats.

Oats are generally the better for being crushed or "kibbled," as it is generally called, by which they are rendered easier of digestion and yield a greater quantity of nutriment. Kibbled oats are specially advantageous to old horses, to those with defective teeth, and to greedy horses who bolt their corn.

Purchase of Oats.

In London, oats are bought in the corn market in Mark Lane. They are bought from small samples, subject to these agreeing with the "bulk" samples, which consist of oats taken on arrival of the ship. This bulk sample is obtained by means of an instrument called a "sample spear," which is thrust down into the oats in the hold of the ship. It brings up about a handful of oats at a time. This process is repeated in various parts of the hold. If a small sample does not agree with the bulk sample the bargain is cancelled or the matter referred to arbitration. Oats are sold by the quarter of 320 lb. for 40 lb. oats, 304 for 38 lb. oats, and so on.

The current rates in 1889, were from 15*s.* 6*d.* to 16*s.* 6*d.* per quarter, in 1890, the prices varied from 17*s.* 6*d.* to 19*s.* 6*d.* per quarter.

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Weight of a Bushel of Various Grain.

		lb.	lb.			lb.
Wheat	weighs from	56	to 65	per bushel.	Mean weight	64½
Rye	„	51	to 58	„	„	54½
Barley	„	46	to 51	„	„	48½
Malt	„	38	to 45	„	„	41
Oats	„	32	to 48	„	„	40½
Peas	„	61	to 69	„	„	65½
Small Beans	„	61	to 68	„	„	64½
Split Beans			62 lb.			

Oatmeal.

When the outer husks of the oat are removed and the kernel ground in a mill, oatmeal is the product. Care should be taken that the husks are not mixed with the oatmeal. It should be fresh ground and sweet; ⅓-lb. is issued in lieu of 1 lb. of oats. It is made into gruel for horses. About a pint of meal will make 4 quarts gruel. For a very exhausted horse, put in another pint of meal, simmer and stir for 10 minutes, and give to the horse with the chill just taken off. Its price is about 12*s.* per cwt. It is sometimes adulterated with barley flour for the purpose of giving it a whiter appearance; in fact, to make meal produced from damaged or poor oats look as if it had been made from grain of a better quality. In making oatmeal gruel, great care must be taken not to use boiling water, as a too starchy compound is thus produced.

Linseed.

Linseed weighs about 55 lb. per bushel and costs about 15*s.* per cwt. It is issued as an equivalent to oats or hay, the quantity being regulated by their respective prices.

Ground linseed or linseed meal is used as a medicine. Linseed is either boiled to a jelly and mixed with the food, or boiling water is poured on the seeds in the proportion of one pint of water to an ounce of seed. The latter must be left to stand till cold, when a thick solution will be obtained.

Other Grain.

Maize (also called mealies and Indian corn), crushed or ground, is often used in lieu of oats, when the price happens

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to be moderate or the quality of the oat crop is indifferent. It answers very well, and some horses put on flesh better with it than with oats. It should be given mixed, with an equal quantity of bran and chopped hay, the whole being slightly wetted. About the same weight of mealies may be given as the horses had been accustomed to of corn. The grains should be sound and free of weevils and maggots. Maize should be given crushed, but if no means of crushing be at hand it should be soaked for twenty-four hours before using.

In some foreign countries other grain is substituted for oats, sometimes because oats cannot be procured, sometimes because those grown in the locality are inferior. Barley is a common substitute. It is more heating than oats, and is apt to produce constipation, derangement of the bowels, and consequent irritation of the skin. On this account it is often desirable to combine with it clover, lucerne, grass or other green meat as a corrective. The same remarks apply to gram, a species of pea, which is commonly used in India as a substitute for oats. When a new description of grain is given to that to which the horse has been accustomed, it is always desirable to introduce the change gradually, if possible. When maize, rye or barley is given to horses, they should not be watered for two hours before and two hours after they have been fed.

Beans.

Beans contain more nutritive matter than oats, but if given in excess are heating. Beans are beneficial to horses employed on very hard work especially to old animals and to those which are a little overtasked.

About 2 lb. per diem, in addition to the usual quantity of oats, is a fair allowance, but the amount may be increased or diminished according to circumstances. Beans weigh about half as much again as oats, and hence servants in giving them out by measure sometimes allow a good deal more than they intend.

Beans should be hard, dry, sweet, plump, sound, one year old, and should weigh from 60 to 64 lb. per bushel. They should invariably be split, as otherwise they are apt to pass whole through the intestines. English beans only should be given. The skins of foreign, especially of Egyptian beans,

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are often so hard as to render them utterly indigestible in the horse's stomach.

Beans, otherwise good, are often damaged by an insect which eats out the kernel. This defect is easily seen. New beans are less nutritious than old, and are moreover apt to produce flatulence and colic. They are invaluable for restoring condition, and are useful to horses which have a tendency to thick or broken wind. A good crop yields a ton of grain and about 1½ ton of straw per acre.

Peas.

Peas should be one year old before being used. They should weigh 64 lb. to the bushel and be sound, sweet, and free from weevils. They should be given split or crushed.

Nutritive Value of Various Kinds of Forage.

100 lb. of good hay (Best Upland), is equal to:—

	lb.	
Clover Hay...	90	(when made in blossom).
Sainfoin Hay	89	
Green Clover	410	
Vetches or Tares (green) ...	457	
Wheat Straw	374	
Oat Straw	195	
Peas-haulm	153	
Mangold Wurzels	339	
Turnips	504	
Carrots	276	
Wheat	45	
Barley	54	
Oats...	59	
Peas and Beans	45	
Wheat Bran	105	
Maize	45	
Linseed	30	

Table.

An acre of grass will yield from 1 to 3 tons of hay.
„ wheat „ 30 to 40 bushels and 1½ tons straw
„ barley „ 40 to 50 bushels and 1 ton „
„ oats „ 40 to 60 „ and 1½ „ „
„ green clover will yield about 12 tons.
„ meadow grass „ „ 10 „

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On poor land, make a deduction of between 25 per cent. and 40 per cent. from above.

28 lb. green forage = 10 lb. oats.
14 lb. bran = 9 lb. oats.
20 lb. unthrashed corn form a ration.

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Section IV.

FUEL AND LIGHT.

The supply of fuel and light to the troops is in peace time carried out by the "Barrack Section" of the Army Service Corps, but in time of war this duty would devolve upon the Supply Branch of the Army Service Corps.

As an officer of the Army Service Corps may at any time be detached for duty with the Barrack Section it is important that he should be able to judge of the quality of fuel and light, and also be thoroughly acquainted with the management of coal yards and the regulations governing issues of fuel and light as laid down in Allowance Regulations, Section VI, and Army Service Corps Regulations, Section III.

"Fuel" is a term applied to any substance used for combustion, for cooking or heating purposes.

The value of any substance as fuel depends on the amount of heat produced during combustion by a certain bulk of the fuel.

There are of course other important points to be considered, such as whether the fuel lights easily, and is capable of being burned in an open grate, or whether it requires the strong draught of a furnace to cause perfect combustion; whether it makes a cheerful fire with plenty of flame, or whether it burns without flame or smoke.

The purpose for which the fuel is intended must be taken into consideration, as a fuel which might be admirably suited for one purpose would be useless for another.

The Assay of Fuel.

Absolute heating power.—The absolute heating power of any fuel is determined by ascertaining the number of degrees Fahrenheit that 1 lb. of the fuel will raise the temperature of 100 gallons of water.

The apparatus used for ascertaining the "absolute heating power" is called a "calorimeter," and consists of a tank containing 100 gallons of water. Under the tank is a chamber

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capable of holding 1 lb. of the fuel to be tested. A pipe leading from the top of the chamber through the tank in a zigzag direction forms the chimney, and a current of air necessary for the complete combustion of the fuel is supplied by a pair of bellows communicating with the chamber.

Specific heating power.—The "specific heating power" of any fuel is ascertained by multiplying the absolute heating power of the fuel by its specific gravity.

Specific gravity.—The specific gravity of any substance means the weight of a certain volume of that substance as compared with the weight of an equal volume of water; thus :—

A cubic foot of gold weighs 1187·5 lb.
„ water „ 62·5 „

That is, gold weighs nineteen times heavier than water bulk for bulk, and therefore the specific gravity of gold is said to be nineteen.

Again, a cubic foot of poplar wood weighs 24 lb., therefore the specific gravity of poplar wood is $\frac{24}{62{\cdot}5}$ or ·384.

In like manner the specific gravity of any substance can be obtained.

The substances used as fuel in the Service are :—

1. Wood (kindling, fuel, and bavins).
2. Charcoal.
3. Coal.
4. Coke.
5. Peat or turf.

Kindling Wood.

Kindling wood is used for lighting fires. Fir, birch, ash, and hazel are the most suitable kinds. All wood for kindling should be dry, sound, and well-seasoned.

Fuel Wood.

Fuel wood is used in camps for cooking and baking purposes. It should be sound, full-grown, not decayed from age, or damaged by caterpillars, nor worm eaten; and if ship timber, should not have been below the water-line.

With an army in the field, in a country where wood is plentiful, no issues of fuel for cooking are made to the troops by

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the Army Service Corps. The troops will provide themselves with wood each day when they halt.

Wood, before being used, should be stacked under cover for a year or two.

It should be felled in mid-winter, as it then contains less sap than at other times of the year.

Woods are classified as "hard," "half-hard," and "soft."

Hard wood includes—oak, beech, birch, elm, box, nut, chestnut, and ash.

Half-hard wood includes—maple, acacia, alder, mulberry, horse-chestnut, larch fir, and Scotch fir.

Soft wood includes—pine, lime, aspen, poplar, and willow.

The hard woods burn without much flame, and produce a glowing fire.

The soft woods burn with plenty of flame, especially the resinous kinds. Therefore the selection of the kind of wood to be used depends upon the sort of fire required.

The presence of water in wood is objectionable, as it renders the combustion imperfect, causing a smoky flame, loss of fuel and much soot.

Ordinary green, freshly-hewn wood contains from 20 to 50 per cent. of water. Air dried wood contains 20 to 25 per cent. of water. The age of freshly-hewn wood may be told by counting the concentric rings in the trunk, each ring representing a year.

To Estimate the Contents of a Stack of Wood.

Find the cubical contents of the stack (in feet) by multiplying length, breadth, and height together. The weight of a cubic foot of average half-hard wood is 26 lb., therefore multiply the number of cubic feet in the stack by 26. This would give the number of pounds in the stack if it consisted of solid wood; but owing to the logs of wood being round, it is necessary to deduct one-fifth for interstices. Therefore the formula is :—

$(L \times B \times H \times 26) - \frac{1}{5} (L \times B \times H \times 26) =$ lb., or 108 cubic feet = 1 ton, about.

This rule applies only to round logs of wood. Recently fuel wood has been supplied to Aldershot from the arsenal at Woolwich. The wood is delivered by barges, and consists of broken packing cases, odds and ends from workshops, broken up gun carriages, &c. The weight of the pieces and the manner in which they pack together varies so much that it

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is impossible to lay down any rule for estimating the contents of a stack, but it was found that a stack measuring 60′ × 20′ × 11′ contained 60 tons, whereas by the beforementioned formula, it would have contained 122 tons.

Fuel wood being generally delivered in 4 foot lengths, a good way to stack wood in camp, where the difficulty of weighing is great, is, to make rectangles 6′ by 4′, and at each corner drive a stake into the ground, leaving 4½ feet above the ground. When the spaces enclosed by these stakes are built up with wood each will be found to contain a ton.

Bavins.

"Bavins" is the name given to bundles of brushwood, which are used for lighting fires in field ovens. Each bundle ordinarily weighs 40 lb. when dry. Bavins, like fuel wood, should be cut in mid-winter and should be stacked in the same manner as sheaves of corn (that is in stooks) to dry. They should consist of the same sorts of woods as fuel wood.

Bavins should be stacked so that the number of bundles may be easily counted, and the number multiplied by 40 will give weight in pounds contained in the stack. Laid on the ground two layers thick, they form a very convenient base on which to stack flour, hay, &c., in the field.

Charcoal.

Charcoal is the residue of wood, burnt out of contact with the air.

It is used in some tropical climates in open air stoves for cooking purposes. It burns with little flame, no smoke, and gives out intense heat. It should be purchased fresh, and used as soon as possible as it absorbs water from the atmosphere very quickly. After a week's exposure to the air in dry weather it absorbs 15 per cent.; in wet weather, if exposed to rain, as much as 60 per cent. It should be of the best quality, made from olive, or equally hard wood, should be very dry, and the Contractor should be paid for the amount weighed into store, and not for the amount issued to the troops. It should be kept under cover. There should always be a surplus of this article on account of its increasing in weight by absorbing water when kept in store.

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Coal.

Coal is classified according to its age, on which its density and behaviour during combustion depend.

The oldest formation of coal is anthracite, the next bituminous, and the most recent formation is called brown coal, or lignite.

Anthracite Coal.—Anthracite, sometimes called "stone coal" or "fossil coal," shows scarcely any vegetable structure, does not soil the fingers, is very brittle, of iron black colour and metallic lustre. It is difficult to ignite, and requires a strong draught or blast to make it burn, but gives out intense heat with very little flame or smoke. It is very valuable for smelting purposes. It is very dense in texture, the average weight of a cubic yard being:—

In America	...	...	2,601 lb.
In Ireland	...	...	2,376 ,,
In Great Britain	...	...	2,278 ,,

Bituminous Coal.—There are many varieties of this coal, the older formations approaching the anthracite in appearance and density. The colour is of various shades of black, sometimes greyish-black. The lustre is more "waxy" than that of anthracite, and in some varieties dull.

"Steam," "smokeless," or "non-caking" coals resemble anthracite in behaviour on combustion. They are difficult to ignite, and require a strong draught. They are chiefly valuable for engines and for smelting purposes. As they do not "cake" in burning no obstruction is offered to the draught in the furnace. They burn with little smoke or flame but give out intense heat. They are unsuitable for combustion in an open grate. The southern Welsh coal is of this type.

The best household coals are of the description called "Pitch" or "Caking" coal. This kind ignites readily, and burns with a yellow flame, emitting jets of gas and giving abundance of flame and smoke. When well heated it combines into a solid mass, thus preventing loss of slack.

The following are specimen collieries, the best coal from which is rated 1st quality, and is of the general household description required under the contract, viz:—

Bignall Hill, Harton, Hetton Lyons, Kelloe, Podmore Hall, Sharlston Wallsend, South Kelloe, and Tunstall (Durham.)

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In testing a coal as to quality, the following points should be noted:—

1. Whether it ignites easily or with difficulty. The more easily it ignites the better.
2. Whether it burns with a long or a short flame. The longer the flame the more cheerful a fire it will make.
3. Whether it binds or cakes together, or whether it breaks up and disintegrates. The more it cakes the better.
4. Whether it generates a smell. Few coals are without sulphur or iron pyrites, but if these are in excess, the coal is of very little value for household purposes owing to the objectionable smell they make when burning.
5. The percentage of ash. There should not be more than 5 per cent.

Unfortunately the better coal is in other respects, the more smoke it produces.

All the above points can be noted by watching the behaviour of the coal on combustion in an open grate, with the exception of No. 5, for which test a "muffle" is necessary. This is a vessel resembling a saucepan in which a carefully weighed amount of coal is put, and then heated in a furnace till the coal is incinerated. The remaining ash is then weighed.

"Torbanite" is a bituminous shale of great value on account of the amount of mineral oil and gas which can be obtained from it. A ton of shale will yield as much as 45 galls. of crude oil, or 15,400 cubic feet of gas.

Brown Coal or Lignite.—Brown coal is the most recent formation of coal. It differs from mineral coal in showing a red streak when scratched with a sharp instrument. If ignited by means of a blow-pipe it continues to burn.

It has very little heating power as compared with its bulk, and can only be used advantageously where it occurs in large masses; and the price of true coal and wood is high. Air dried brown coal contains 20 per cent. of moisture.

Coke.

Coke is used for Government laundries, wash-houses, and various stoves and ovens. It is the residue of coal after the

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gas has been driven out of it by heat. Coal usually loses about 25 per cent. in the process of being converted into coke. During this process it increases 25 per cent. in volume.

Good coke should have a metallic lustre, should be of an iron grey colour, should have a fused appearance and should be porous; it should not soil the fingers. There should not be more than 12 per cent. of ash. There is sometimes as much as 20 per cent. of moisture in coke.

It is valuable for smelting purposes in blast furnaces.

100 parts of coke = 250 parts charcoal.
100 lb. ,, = 80 lb. ,,
Coke occupies about 82 cubic feet to the ton.

Turf or Peat.

Turf is found largely distributed throughout Scotland and Ireland, and in some parts of England. It is formed by the growth of a moss, and extensive tracts of turf bog may be seen standing higher than the surrounding country. These bogs are usually covered with heather.

In preparing the turf as fuel, the heather is cut off, and the sods of turf are cut out by means of a spade specially made for the purpose. The top layer is useless as fuel, being very porous, spongy, and composed chiefly of heather roots. The second layer makes indifferent fuel, being also very porous, absorbing large quantities of water. Each succeeding layer becomes more solid and more nearly approaching the formation of coal. Sometimes these turf bogs are as much as 40 feet in depth.

The turf when cut is spread out to dry, and afterwards stacked in small clamps so as to allow rain water to drain off. The quality of turf depends mainly on the amount of water contained in it and on the percentage of ash. There should not be more than 10 per cent. of water, or 3 per cent. of ash. The percentage of water may be ascertained by weighing a certain amount and placing in an oven at a temperature of 212° F. until it ceases to lose weight. The difference between first and last weighing will give the percentage.

The best turf for fuel is black in colour, and very dense and hard. Light brown turf is only fit for kindling purposes.

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Management of Coal Yards.

In order to ensure a thorough supervision at all times of a coal yard, it is necessary to have it so arranged that stock can be correctly and rapidly taken at any moment. Now, a ton of loose screened coal occupies a space of 42 cubic feet, and therefore, if the coal be stacked in such a manner that the cubic dimensions of the different heaps can be accurately determined, it is easy to ascertain the amount of coal in the yard.

It is impossible to lay down fixed rules as to what the dimensions of a heap should be, as these must vary according to the available space in each yard.

In any case there should always be at least two heaps in each yard. Issues should be made from one heap, and coal received at the other.

On no account should issues take place from the same heap where deliveries are being made. Neglect of this rule will cause complications in account and give opportunity for fraud.

In order to mark out a yard, the first step to be taken is to determine the number of heaps each of 50 or 100 tons to be made. Then allowing for a passage between the heaps, ascertain the width and length available for each heap. The following formula will give the height:—

$$\left.\frac{\text{Length} \times \text{Width} \times \text{Height in feet.}}{42 \text{ (cubic feet).}}\right\} = 100 \text{ tons.}$$

Therefore if the length and width available for each heap of 100 tons are say 35 and 20 feet respectively, then:—

$$\left.\frac{35 \times 20 \times \text{Height}}{42}\right\} = 100 \text{ tons}$$

$$\therefore \text{ Height} = 6 \text{ feet.}$$

In a similar manner the length and width can be determined. The height should never be over 6 feet on account of the difficulty of stacking to a greater height.

The heaps should be arranged, if possible, so that at least two of their sides should rest against the walls of the yard in order that only two walls of coal need be built and labour saved accordingly.

In the present case, therefore, a horizontal line 6 feet from

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the ground should be painted in the angle of the wall 35 feet on one side and 20 feet on the other. It should be divided off into feet, beginning at one from the angle of the wall on each side and ending at 35 and 20 respectively, and the number of each foot should be painted over the line.

The coal should be carefully stacked as high as the elevation line, and the outside walls neatly built parallel to the painted lines denoting the length and width.

The surface should then be carefully levelled.

A separate account is kept by the Issuer for each heap, and when the heap is run out the total issues from it should be compared with the original quantity received.

The requisition on the Contractor should be for the quantity necessary to make a complete heap, no more or less.

The heap that has been longest in the yard should always be the first to issue from, as coal deteriorates very rapidly from exposure to the sun, wind, and rain.

The number of each heap and its contents when full should be painted in a conspicious place on the wall for the guidance of the Issuer, who keeps a separate account for each heap.

When large stocks are kept the non-commissioned officer in charge of the yard is required once a week to render to the Barrack Office a state, of the week's receipts and issues. This state, which shows at a glance the stock on hand, is forwarded to the Barrack Office on Saturdays accompanied by the Issuer's book of receipts and issues in which all transactions have been posted daily as they occurred. The whole are then carefully examined and compared with the office records, when, if correct, the state is filed for future reference if necessary, and the book initialled and returned to the Issuer.

Receipts of Fuel.

The Officer in charge of Barracks having determined on the amount of coal that will be required for the ensuing month, sends to the Contractor, not later than the 20th of the month, a requisition for the number of tons of coal required to be delivered at the different coal yards on certain fixed dates during the following month. This detail is necessary in order that not only may the necessary quantity be delivered into each yard, but also that the Officer in charge of Barracks

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may have a thorough supervision of the receipts in detail as each cart load arrives at the place appointed. On the duplicate of this requisition the delegate of the Officer in charge of Barracks fills in the detail of receipts as the coal is received, and in this manner it can be seen whether the actual receipts are in compliance with the demands made.

The Contractor having received the requisition for coal from the Officer in charge of Barracks, renders as soon as possible to that Officer a pit certificate as follows:—

Bignall Hill Colliery,
June 10th, 1884.

I hereby certify that the coals consigned this day to Messrs. Lowthin & Co., are of the best description, known under the designation of "Best Bignall Hill," and that they are fresh wrought, properly screened, and free from dust at the time of loading.

F. JONES, *Manager.*

Aldershot, B.H.C. 456, 567, 317.

On arrival at the station, the coal trucks should be checked by an officer or other representative of the Army Service Corps with the pit certificate, care being taken to see that no other coal is being received by the Contractor than that recorded in the pit certificate, or if so, that such is not for issue to the troops. The consignment having been found to be correct, the coal may be delivered into the yards, each load passing over a weigh-bridge, the gross, tare, and net weights being taken, and the detail entered on checks.

This weighing should be done by, or in the presence of, the Issuer in charge, and no supply received except in his presence, otherwise a shifting of responsibility, should deficiences or errors occur, will probably be the result. If delivered in sacks, at least two from each load should be weighed.

The following is the usual course at large depôts:—

The receipt checks are in duplicate, one being given to the Contractor and the other retained by the Issuer. The latter having entered the receipts in his receipt book signs the check and gives it to the Superintending Warrant Officer in charge of coal duties, who, on the following morning, sends to the Barrack Office a recapitulation of all receipts for the day previous, to which the receipt checks are attached as vouchers. At the end of each day the Issuer's yard book is compared with these checks and, if found correct, the

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amounts received are entered against each coal yard in the fuel receipt book, and it is by this latter book that the Contractor's bill is checked when presented at the end of the month.

The weight of coal as per pit certificate should be entered in a register and compared monthly with the quantities taken on charge. Otherwise it may happen that at the end of a contract, more coal may have been received than left the pit.

This may happen from the following causes:—

1. Inferior coal from other pits being fraudulently delivered.
2. The tare being incorrectly marked on the Contractor's trucks for the purpose of fraud. To check this, the quantity of coal in a truck should be occasionally weighed and compared with the pit certificate, and if necessary, a report should be made to the colliery direct.
3. Surpluses not being brought to account, but made away with by receipts being given to the Contractor for coal not received.
4. The coal being improperly weighed into the yards. N.B.—The weigh-bridges should be frequently tested, and care should be taken that the adjusting keys are not improperly used.

The leading points in the management of reserve coal yards are:—

1. Division of the yard in correctly marked out and properly stacked heaps, each containing a fixed quantity of coal and so arranged that one heap is run out and checked before another is commenced.
2. To arrange that all consignments are received and all issues made in the presence of the Issuer.
3. Not to allow receipts and issues to be made to or from the same heap.
4. To see that the coal described in the pit certificate is actually put into the yard and no other.
5. To see that the amount of coal received does not exceed the quantity that leaves the pit as shown on pit certificates.
6. Monthly stock-taking and checking of accounts at short intervals.

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7. Not to allow surpluses to accumulate, but always to take them on charge to the full extent as soon as discovered.
8. To insist on the cause of any deficiency being enquired into and the matter settled at once.
9. If a transfer becomes necessary between two Issuers, the transfer should always be witnessed by an officer.

It is to be noted that each ton of coal enumerated on a pit certificate consists of 21 cwt.

Coal should, when possible, be kept in covered sheds, and not exposed to the action of the sun, wind, or rain, nor should it be kept even under cover for a long time exposed to the action of the air. The pyrites contained therein decompose and the hydroxide of iron, which is the result, gives to the coal a rusty stain, which depreciates its value. Finally, the schists disintegrate, effloresce, and the deterioration becomes rapid. The heat of the sun partly cokes the coal, the gases, which produce the flame escaping into the air, whilst the carbon, which is left, disintegrates and produces large quantities of slack.

It is stated that if one coal, measuring exactly a cubic yard (nearly equal to 5 bolls), be broken into pieces of a moderate size, it will measure $7\frac{1}{2}$ bolls, if broken very small it will measure 9 bolls, which shows that the proportion of the weight to the measure depends upon the size of the coals, therefore accounting by weight is the most rational method. When coal was sold by measure, any dishonest dealer was able to cheat by breaking his coals a little smaller than usual, as if he had sold them in deficient measures. The sale of coal is now made by weight which removes the temptation to break coal, and the necessity and waste incurred by "screening."

Screened coals are those that are passed over gratings to separate the smaller pieces called "smalls" or "slack." "Round" coal means massive coal in large lumps and free of slack.

"Selected," or hand-picked coal, means a quantity of coal consisting exclusively of large lumps.

42 cubic feet of loose screened coal weigh a ton.
40 „ „ unscreened „ „

One bushel of coal, measured when dry, weighs about 80 lb. The same bulk of coal, if measured when wet, paradoxical as it may appear, will weigh less. The fact is proved

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conclusively, that in the dry coal, the small particles run to fill up the cavities, making the whole an almost solid mass, whereas in a bushel of wet coals, the hollow cavities are closed over, the fragments clog together and the whole does not weigh so much as a similar measure of dry coal.

Charter-Party.

"Charter-party" is the name given to a contract in writing between the owner or master of a ship and the freighter, by which the former hires or lets the ship under certain specified conditions for the conveyance of the goods of the freighter to some particular place or places. Generally, nowever, a charter-party is a contract for the use of the whole ship; it is in commercial law what an indenture is at common law. No precise form of words, or set of stipulations, is requisite in a charter-party.

Stock-taking.

Stock-taking in a well organised coal yard is a simple process, for the dimensions of each heap are so marked out by painted lines and the coal so stacked that each heap contains, when complete, a known quantity of coal, say 100 tons. The amount of coal which each heap, when complete, will contain, should be painted on the wall, and for an unbroken heap the quantity so marked may be accepted as correct. To ascertain the amount of coal in a broken heap, or to prove the correctness of the amount contained in a complete heap is easily done by means of the afore-mentioned formula, *i.e.*, multiply the height, length, and breadth together in feet, divide the product by 42 and the result will give the number of tons of coal in the heap. The cubic measurement of one ton of coal is as follows :—

	Cubic Feet.
Screened and recently stacked	42
„ after six months	41
„ after twelve months	40
Unscreened	40

As all coal delivered at home stations should be screened, and is seldom kept more than one month in the yard, 42 cubic feet to the ton is the measurement invariably recognised.

After the coal has been stacked for some time, the gradual effects of time, weight, and exposure cause it to break up,

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and the dust and slack thus produced fill up all the little interstices, and consequently increase the density. The same effect is caused by the slack and dust in unscreened coal.

In taking stock of coke, the stock on hand is usually so small, that in the event of there being any doubt as to the quantity, as shown on hand, being actually present in the yard, it would not entail much labour or time to weigh the whole. Coke occupies about twice the space of coal, *i.e.*, 82 cubic feet to the ton.

Before taking stock of a reserve coal yard, it should be seen that the Issuer's book is closed for the day, and a memorandum should be taken of the remains on the day as shown on the Issuer's book, as well as of the quantities actually found in the yard. The difference, if any, between the two being the surplus or deficiency in the yard. Should any surplus be found, it should be at once taken on charge in the Issuer's book, as the making of a surplus should always be discouraged, and if not taken on the Issuer's charge it may lead to serious irregularities. Deficiencies should always be carefully enquired into at once.

When taking stock in coal yards, the opportunity should be taken to check all the implements as detailed on the inventory board.

LIGHT.

The substances used in the Service for the production of light are :—

1. Candles (Paraffin or Stearine and Barrack).
2. Oil (Mineral and Vegetable).
3. Gas.

Candles.

Candles are of two sorts, "Dips" and "Moulds." The former are made by repeatedly dipping the wicks into melted fat, allowing a sufficient time between each dipping for the tallow to cool. The wicks are made of loosely rolled cotton, and the dipping is performed by machinery, one man being able to turn out from 7,000 to 8,000 candles per day.

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Mould candles are made in a tubular mould, the wick (which is composed of plaited cotton and waxed before being used) is held in the centre of the mould by means of wedges, and the tallow is then poured into the mould, which is highly polished so as to enable the candle to be drawn out when thoroughly set.

Candles are made of various substances—animal fat or tallow, palm oil, cocoa-nut oil, spermaceti, wax and paraffin.

All these substances require to go through various processes to render them fit for the manufacture of candles.

The quality of a candle depends on :—

1. The amount of light it is capable of producing.
2. On its having a high melting point.
3. On its remaining stiff (that is not bending over) at a high temperature.

Spermaceti Candles.—Spermaceti is obtained from the head of a species of whale.

Sperm candles contain about 3 per cent. of wax, which is added to prevent cystallisation. A sperm candle (six to the lb.) should burn at the rate of 120 grains per hour and should have a melting point of 120° F. This kind of candle is generally taken as the standard of comparison for all other illuminating agents, the light being clear, white, and very brilliant.

Wax Candles.—Wax is obtained from bees and from various vegetable productions. Wax candles are seldom composed of pure wax, but consist of wax and stearine in various proportions. The melting point of pure wax is 148° F. The light produced by the best wax candles is $\frac{1}{12}$ less than that of sperm candles.

Paraffin Candles.—Paraffin is obtained by the destructive distillation of bituminous shales. Pure paraffin melts at a temperature of 110°, but becomes soft when warm and can be bent into any shape; therefore candles made of pure paraffin are unsuitable for burning in warm temperatures. Candles intended for the tropics are as a rule composed of paraffin and stearine in certain proportions. The light produced by the best paraffin candles is $\frac{1}{12}$ less than that of sperm candles.

Stearine Candles.—Stearine is a name given to various fatty acids from which candles are made. The fats usually

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employed are palm oil, refuse grease from glue-making and bone-boiling, and ordinary tallow. Stearine candles usually melt at 130° F., they burn at the rate of 140 grains an hour (at six to the lb.) and give a light in the proportion of 16·5 stearine to 15 sperm. The advantages of stearine candles are great regularity in burning, absence of all disposition to gutter, not softening in warm climates or hot rooms, and not soiling the fingers or clothes. Stearine candles will probably ere long supersede every other description.

Tallow Candles (Mould).—Mould candles of tallow are usually made of the better description of tallow. They burn at the rate of 143 grains an hour, and give a light one-half less than that of sperm candles. They melt at a very low temperature, gutter when exposed to draughts, grease everything with which they come in contact, and in warm weather are apt to break.

Dips.—Dips made of tallow are very inferior; they have a very low melting point, require constant snuffing, burn with great irregularity, and give a light $\frac{1}{3}$ of sperm candles.

Testing Candles.

In order to test candles as to their light-giving powers, an apparatus called a "photometer" is necessary.

When such a test is required it is best to send a sample of the candles to the War Department Chemist.

To roughly compare one description of candle with another, a sample of each kind should be burnt under similar circumstances and their behaviour noted. They should not gutter or require snuffing, nor should they bend over if the temperature be warm.

In order to ascertain the melting point perhaps the most convenient method is to submerge them in water at a temperature of 60° F., and gradually raise the temperature by means of a spirit lamp, and note the degree of heat at which each sample becomes soft, and whether it becomes flexible or brittle.

Paraffin or stearine candles are ordinarily issued for offices and for warrant officers. Composite (known as "barrack") for all other services.

Oils.

Vegetable Oil.—The vegetable oil most commonly used in the Service is colza oil. It is used for burning in signalling

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lamps, &c., and for lubricating machinery, as it retains its fluidity when exposed to frost better than most vegetable oils.

Colza oil is obtained by pressing the seeds of a species of cabbage largely grown in Belgium for the purpose. It should be of the quality known as "best refined."

Mineral Oils.—These are of two kinds, "petroleum" and "paraffin." The descriptions supplied to the Service are water-white petroleum and paraffin, with a flashing point not lower than 105°.

Petroleum is a natural product and is obtained from wells sunk in the ground. The oil flows naturally from some of these wells, and in others it has to be raised by pumping. Petroleum occurs principally in the United States, in Canada, Southern Russia, and Burmah.

The American petroleum is the purest, yielding about 75 per cent. of burning oil, while the Russian variety does not yield more than 35 per cent.

Paraffin, on the other hand, is a manufactured article, and is obtained by the destructive distillation of bituminous shales.

Some shales yield as much 45 gallons of crude oil per ton.

The burning oils of commerce are obtained by distilling the crude petroleum and paraffin oils.

In distillation, the first products to pass over are very volatile; after these comes a volatile liquid from which "gasoline" and "benzine" are obtained. Next is obtained the "kerosine" or burning oil, while finally are obtained various lubricating mineral oils such as "vaseline."

The kerosine oil thus obtained by distillation is next treated with oil of vitriol and then with a strong solution of caustic soda.

If required, it is bleached by being exposed to sunlight in glass covered tanks.

Paraffin oil ignites more slowly than petroleum, and is therefore safer, while it gives an equally good light. It is, however, slightly yellower in colour and has rather more smell, though this is not noticed in burning.

Good mineral oil should be colourless or slightly yellow, it should have very little smell, it should have a specific gravity of about 800, and its flashing point, *i.e.*, the lowest temperature at which it gives off inflammable gas, should not be less than 100° F.

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The flashing point fixed by Act of Parliament is 73° by that known as the "close test."

In judging the quality of oil, therefore, the following points are to be observed:—

1. Flashing point.
2. Lighting powers.
3. Colour.
4. Odour.

Flashing point.—To ascertain the "flashing point," "Abel's Test Apparatus" is required. Full instructions for its use are issued with each apparatus.

Most of the American water-white petroleums flash at from 110° to 125° F. Paraffin oil usually flashes at from 95° to 105° F. Some specially prepared oils flash at 240° F.

Sometimes oils with a heavy specific gravity are mixed with inferior petroleum in order to give it a high flashing point.

To ascertain the comparative lighting powers of oils, they should be burnt in precisely similar lamps, and tested by means of Bunsen's Photometer. A very fair idea of the quality of oil may be formed by observing the brilliancy of the flame without any special apparatus.

No oil, however good, will give a good light unless the lamps be kept scrupulously clean and fresh filled every day, the wick thoroughly dried before use, accurately fitted to the burner and carefully trimmed with a sharp pair of scissors.

The following instructions with regard to the manipulation of a lamp should be carefully followed:—

1. See that you get the right size wick, not too narrow or too thin. It should just fill the wick case both in width and thickness.
2. Thoroughly dry the wick. This is most important or the oil will not flow up to keep the flame supplied. If, when the wick is turned up to its full power, the flame gradually diminishes in size, the cause is almost sure to be dampness of the wick.
3. Before putting a new wick in the burner, cut it evenly across the top, taking care not to jag the edges; then insert it evenly in the tube.
4. Cut the wick perfectly level with the top of the wick case. The flame of a paraffin burner should be

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square at the top, and not pointed in the centre. If the flame be forky, a little may be taken off the corners of the wick.

5. In cutting the wick of a lamp that is in use, remove merely the charred part that will cut easily.
6. Fill the oil vessel each time before using.
7. To light the lamp, never use a candle or wax match. Do not turn up the wick above the cone. The wick of every burner fitted with a cone should be some way below it and quite invisible.
8. When first lit, do not turn up the flame to its full height.
9. In extinguishing a lamp use the extinguisher; if the lamp is not fitted with one, blow sharply across the top of the chimney after turning the wick low.

In testing samples of oils, the amount of each consumed per hour should be noted. They should of course be burned in precisely similar lamps.

In testing for "colour," pour some of the oil into a wine-glass and hold up to the light. "Water-white" petroleum should be quite colourless, and if looked at from below against the light, a blue nimbus should be seen on the surface.

Paraffin oil should be a very light yellow colour.

With regard to odour, no paraffin or petroleum is devoid of smell, but the less there is the better.

Gas.

Gas is obtained from coal, and is always supplied to barracks, &c., by gas companies.

For the regulations affecting the supply and consumption of gas, see Army Service Corps Regulations, and Allowance Regulations, Section VI.

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Section V.

FIELD AND HOSPITAL SUPPLIES.

The regulations governing issues of groceries and hospital supplies will be found in Section II of the Allowance Regulations.

Groceries are provided regimentally at the men's expense, except at some foreign stations, and in the case of active service in the field. When, under exceptional circumstances at home, groceries are supplied on repayment by the public, the following articles are issued:—

Bread, tea, sugar, coffee, salt, and pepper.

In the case of active operations in the field the troops are supplied with a free ration consisting of:—

Meat (fresh or preserved), bread, or biscuit, or flour, tea, coffee, sugar, salt, pepper, fresh or compressed vegetables, lime juice, and rum (these last two articles at the discretion of the G.O.C.).

In order to meet exceptional cases, a table of equivalents is laid down in paragraph 22, Section II, Allowance Regulations. In addition to the articles already mentioned this list comprises—rice, porter, preserved potatoes, peas, onions, or leeks, split peas, calavances, dholl, oatmeal, bacon and cheese.

Tobacco and soap are also supplied to troops in the field on repayment. In the Nile Expedition of 1884-85, and the Bechuanaland Expedition of same year, the Orders for the scale of rations issued to the troops were as follows:—

NILE EXPEDITION.

I.—Ordinary Field Ration (Daily).

1¼ lb. fresh, or 1 lb. preserved meat.
1¼ lb. bread, or 1 lb. biscuit or flour.
⅓ oz. tea.
⅓ oz. coffee.
2¼ oz. sugar.
½ oz. salt.
1/36 oz. pepper.
1 lb. fresh vegetables, or 1 oz. compressed vegetables, or 1 tin erbswrust.
1/320 gallon lime juice, with ¼ oz. sugar.

II. When any other articles of food become available, they may be substituted for the above on the scale laid down in

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Section II, Allowance Regulations, or (when the regulation does not apply) as may be laid down by the General Officer Commanding from time to time in orders.

III. Tobacco and soap on repayment.

IV. Boat ration (only to be drawn when ordered by the General commanding the expedition):—

Preserved corned meat, 1 lb. on four days out of six.
Preserved fresh meat, 1 lb. on one day out of six.
Ham or bacon, 1 lb. on one day out of six.
Fresh meat, 1 lb. in substitution for 1 lb. of any of the foregoing whenever it can be procured.
Cheese, $\frac{3}{4}$ oz. daily.
Biscuit, navy or cabin, 1 lb. five days out of six.
Flour, 1 lb. one day out of six.
Bread, $1\frac{1}{4}$ lb. in substitution for 1 lb. of biscuit whenever procurable.
Baking powder, $\frac{1}{2}$ oz. to 12 lbs. of flour.
Cabin biscuit will not be made use of except for sick men until sanctioned in general orders.

Daily:—

1 oz. tea.
3 oz. sugar.
$\frac{1}{4}$ oz. salt.
$\frac{1}{36}$ oz. pepper.
$\frac{1}{2}$ oz. rice.
1 oz. preserved vegetables, or 12 oz. fresh vegetables
$\frac{1}{1280}$ gallon vinegar.
$\frac{1}{320}$ gallon lime juice.
1 oz. oatmeal.
Pickles, $\frac{1}{2}$ oz. four days out of six.
Jam or marmalade, $1\frac{1}{8}$ oz. two days out of six.
Erbswurst, 1 tin every three days.
Tobacco, $\frac{1}{2}$ lb. every fifteen days.
Soap, $\frac{1}{2}$ lb. every fifteen days.
Being on repayment, these quantities may be modified so that the total quantities of 40 lb. tobacco and 35 lb. soap for one hundred days for twelve men be not exceeded.

V. Medical comforts will only be issued on the order, in writing, of a Medical Officer.

VI. Spirit ration, $\frac{1}{64}$ gallon of rum, only on special recommendation of the Senior Medical Officer, and special sanction of the Officer Commanding on each occasion of issue.

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VII. Natives' (Egyptian) ration, 1 lb. bread. rice, biscuits, or flour; ½ lb. meat, fresh or preserved; coffee, ⅓ oz.; sugar, 2 oz.; salt, ½ oz. daily.

VIII. The ration of forage will be daily as follows:—
For English horses, 10 lb. corn, 12 lb. hay or chopped straw, 1 oz. salt.
For native horses and mules, 8 lb. barley, 8 lb. chopped straw, ½ oz. salt.
For camels, 10 lb. beans, 15 lb. chopped straw.
The scale of equivalents laid down in paragraph 148, Section IV, Allowance Regulations, 1890, will be in force, with the addition that ¾ lb. hay-cake will be equivalent to 1 lb. corn.

IX. The daily ration to Aden camel-drivers will be:—
Biscuit or rice, 1½ lb.
Dates wet, 1 lb.
Ghee, 2 oz.
Sugar, 2 oz.
Coffee, ⅓ oz.
Salt, ½ oz.
Onions, when procurable, 2 oz.
Or dholl, 4 oz.

BECHUANALAND FIELD FORCE.

Scale of Rations.

1. The daily rations for each officer and man is as follows:—
Meat.—1¼ lb. fresh, or 1 lb. preserved. (Meat-tin openers must be drawn by regiments and corps from the Ordnance Store Department.)
Bread.—1¼ lb. fresh bread, or 1 lb. biscuit, or 1 lb. flour or meal.
Groceries.—1 oz. coffee or ½ oz. tea, or half the ration of each; 3 oz. sugar; ½ oz. salt; 1/36 oz. pepper; 1 oz. chocolate, when given as part of the iron ration, in lieu of the ration of tea or coffee. (Rations will be issued at such times as will enable the troops, marching during the night or early morning, or who are under arms before daybreak, to have a cup of coffee or cocoa before they start, and to carry ½ lb. of biscuits in their haversacks.)

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Lime Juice.—½ oz., when fresh vegetables are not issued, if the Medical Officer considers the issue necessary. (20 oz. are equal to 1 pint.)

Vegetables.—1 oz. compressed, or 1 lb. potatoes, or other fresh vegetables, or 2 oz. split peas, or ¼ lb. onions, or 2 oz. rice, or 1 tin erbswurst.

Spirits.—½ gill (not exceeding three days a week) on the march; ½ gill in camp, when notified in General Orders.

2. The daily ration for natives attached to the force, including native drivers, is 1 lb. mealies, flour or meal, and 1½ lb. fresh meat, and ½ oz. salt.

3. White or coloured drivers, with mule or ox wagons, will receive the ordinary soldiers' rations of bread-stuff, meat, and groceries only.

4. Fresh meat and bread will always be issued when practicable. * * * * *

All hospital supplies are obtained from the Army Service Corps by the Medical Staff by requisition. They comprise the following articles:—meat, bread, tea, sugar, milk rice, fowls, fish of different kinds, salt, butter, potatoes, barley, vegetables of different kinds, flour, eggs, arrowroot, sago, tapioca, oatmeal, fruits in season, lemons, cinnamon, extractum carnis, calves'-foot jelly, malt liquors, wine, spirits, soda water, lemonade, &c.

It is important that officers of the Army Service Corps should be able to judge of the quality of the various articles supplied as a grocery ration and for hospital diets.

In many cases of hospital supplies the terms of the contract, if complied with, ensure that the articles are of the required quality, and with these terms every officer should be familiar.

Bread, flour, biscuit, and meat have been already dealt with under their respective headings; the other supplies will now be taken.

Tea.

Tea is the dried leaf of different species of Thea, a section of the genus Camellia. The varieties of the shrubs are not numerous, and the difference between the various teas of commerce depends principally upon the selection of young or old leaves, and special treatments in drying and otherwise preparing the leaf.

The varieties of tea imported are numerous, but it is seldom that any of them are sold unmixed, for the wholesale tea

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merchants endeavour to improve their teas by "blending." The most common sorts are—Gunpowder, Hyson, Congou, Capers, and Indian tea.

The teas of commerce are divided into "black" and "green," and they differ merely in accordance with the method of preparation.

The black-tea leaves are allowed to lie in heaps for 10 or 12 hours after they have been plucked, and during this time they ferment. They are then dried and rolled several times, and finally roasted.

In preparing green tea, the leaves are roasted for a few minutes directly they are picked, then rolled, and finally dried over the fire. Green tea should be of a yellow or olive-green tint.

The description of tea usually bought for the use of the Army and Navy is Congou of good medium quality. Tea is largely adulterated in China; but since the reduction of duty, adulteration is now seldom practised in this country.

The infusion of pure tea should be fragrant to smell, not harsh or bitter to taste, and should not be too dark.

The question of judging the quality of tea is a difficult one. and requires large experience and an accurate sense of taste, The best teas are made from young leaves, and there should not be a large percentage of stalk or dust. To judge of the age of the leaves, an infusion should be made and the leaves spread out, when the age can be estimated by the size of the leaf. (*See* Plate.)

Detection of Adulteration in Tea.

This may be considered under the five following heads:—

1. Foreign leaves.
2. Exhausted tea leaves.
3. Lie tea.
4. Admixture of quartz, sand, and magnetic oxide of iron.
5. Colouring matter used for facing tea.

1. *The Detection of Foreign Leaves.*—These may occur, either more or less entire or in the form of dust, either loose or gummed together by means of a solution of starch. In either of the latter cases the aid of a microscope is necessary, but if the leaves are entire or nearly so, and if, after infusion, they be spread out, the difference between them and the real tea leaves may be seen. In the tea leaf the border is serrated nearly, though not quite, up to the stalk. The primary veins

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run out from the midrib almost to the border, and then turn in, so that a distinct space is left between them and the border.

The leaves generally used for adulteration are camellia, sloe, hawthorn, willow, elder, beech, and oak. Plates of these leaves are given.

2. *Exhausted Tea Leaves.*—The presence of these may be detected by the unnaturally glossy appearance and the occurrence of many flat pieces. They are treated with a solution of gum, are re-rolled and dried. In doubtful cases, 100 grains of the suspected tea should be weighed, and the leaves exhausted by boiling with repeated quantities of water, until the infusion is no longer coloured. The leaves should then be dried and re-weighed, the difference between the first and second weighings being the soluble extract. Any addition of exhausted leaves of course lowers the percentage of extract. The extract of genuine tea appears to vary from 26 per cent. up to more than 40 per cent. The rule of the Public Analyst is that "tea, *as sold*, shall yield at least 30 per cent. of extract."

3. *Detection of "Lie Tea."*—Lie tea is composed of little masses of tea-dust gummed together to resemble the rolled tea-leaf. If boiling water be poured on it, these little masses break up and disintegrate, leaving a dirty residue, instead of unrolling and expanding as the true tea-leaf does.

4. *Detection of Quartz, Sand, and Magnetic Oxide of Iron.*—The presence of the two first can best be detected by incinerating a weighed portion and again weighing the ash. The percentage of ash in genuine tea never reaches 8 per cent An ash beyond 8 per cent., calculated on the dried tea, is certainly adulterated. If sand be present in "lie tea," it may be detected by pressing the little masses between the teeth; if sand is present they will feel gritty. The presence of magnetic oxide of iron may be detected by pounding a few grains of the tea in a mortar, and then spreading the dust on a sheet of paper. By drawing a magnet along the under-surface of the paper, the particles of iron may be separated.

5. *The Detection of the "Facing" of Tea.*—The principal substances used are black lead, Prussian blue, indigo, turmeric, and china clay. There has been much dispute as to whether "facing" is to be considered an adulteration; it is entirely a question of degree, and each case must be judged of by its merits. To detect, wash a portion of the tea in cold water,

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set aside the washings for a time, when the colouring substances will gradually subside to the bottom. It should be borne in mind that if water contains much lime or iron, it will not make good tea, in each case the water should be well boiled with a little carbonate of soda for 20 minutes, and then poured over the leaves. Tea should be made with boiling water, but should not be boiled, otherwise it will taste bitter.

Coffee.

The coffee berry is the seed of the coffee tree dried and deprived of its fleshy coverings. Before use the berries are roasted to a chocolate brown, and then ground in a mill. The berries improve in flavour by keeping They are seldom adulterated when whole. Adulterations occur principally in ground coffee.

The substances used are principally chicory, roasted wheat and beans, rye and potato flours, mangel-wurzel, acorns, lupine seeds, ground date stones, and burnt sugar.

Chicory is the root of the wild endive; the roots are roasted, lard is added, and they are then ground. Chicory is often supposed to improve the flavour of coffee, but this is a mistake; it has nothing to recommend it beyond its cheapness. Pure coffee cannot be obtained in this country much under 1*s.* 6*d.* per pound. The price of chicory, when purchased wholesale, varies from 2*d.* to 3*d.* per lb. The temptation therefore to adulterate coffee with chicory is very great.

To Detect the Presence of Chicory.

1. Pour cold water over the mixture; chicory, if present, will deeply colour the water, while pure coffee will only do so to a slight extent, and by the depth of the colour the proportion of chicory maybe estimated.

2. Sprinkle a little of the mixture on some water in a glass. If chicory be present it will sink at once to the bottom, whereas coffee will float for some time. Some should also be shaken up with water in a glass, the coffee will rise to the surface, and the chicory will sink. Sometimes, however, the chicory may adhere to the coffee and float with it.

3. Chicory contains so much gummy matter that if the powder be slightly moistened and kneaded, it will form a coherent mass, which can be moulded into any form.

If pure coffee be treated in this manner, it will not cohere in the slightest degree.

4. The infusion of pure coffee is bright and transparent. It has a rich aroma and taste, whereas the infusion of chicory

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has little or no perfume, a sweetish taste, and is dark, thick, and sticky

Further, the specific gravity of the infusion of pure coffee is about 1008·7, whilst that of chicory is about 1024·8.

The specific gravity of infusions of all substances used for the adulteration of coffee is much higher than that of pure coffee.

Most of the adulterations other than chicory can only be detected either by chemical analysis or the microscope, and the methods need not be here described.

When on active service, it should be borne in mind that roasted coffee, whether ground or unground, should be packed in tins with closely-fitting covers, or in bottles with tightly-fitting corks, for it rapidly loses its aroma when exposed to the air. In making coffee, it should not be boiled; it should be made by pouring boiling water over it.

Sugar.

The chief sugars which occur in commerce are "cane sugar" and "grape sugar" or glucose. Chemically, however, there are many varieties of sugar.

"Cane sugar" or "saccharose" is widely distributed throughout the vegetable kingdom, especially in the grasses, such as sugar cane, maize, &c. Also in many roots such as "beetroot," "carrot" and "parsnip." It also occurs in the stems of birch and maple, and in several kinds of palms, as well as in most fruits and in honey.

"Grape sugar" or "glucose" occurs largely in fruits, honey and starch, often mixed with cane sugar. It is sometimes used to adulterate cane sugar.

Sugar, however, is usually unadulterated; but cheap sugars, manufactured from molasses imported into this country are frequently mixed with high-priced sugars.

Ordinary brown sugar contains, almost invariably, fragments of the tissue of sugar cane, and sometimes fungi, acari or sugar mites, glucose and other impurities, from which white or refined sugar is entirely free.

White, or refined sugar, should be—

1. Very white.
2. Very dry.
3. Very hard.
4 Inodorous.
5. Highly crystalline.
6. Entirely soluble in water.

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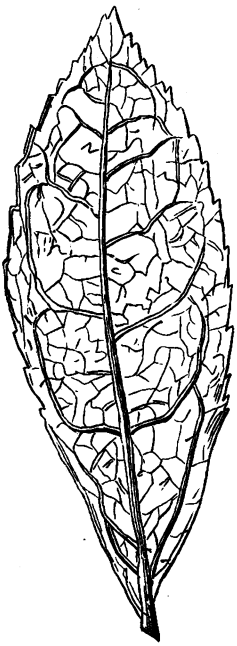

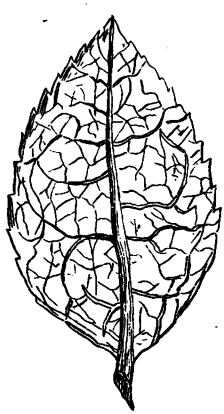

Leaves of the Tea Plant

A, Young leaf; B, Leaf of Black tea of medium size;
C, Leaf of Black tea of larger growth.

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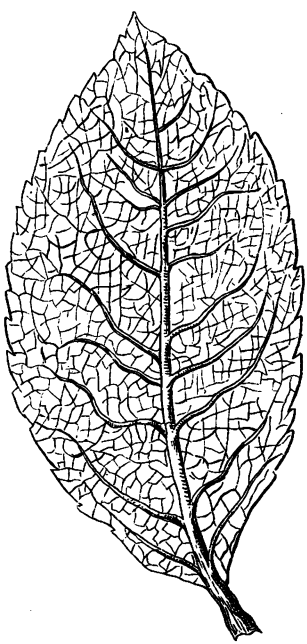
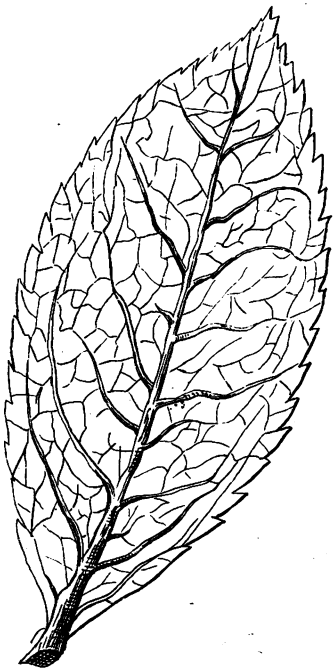
Plate XV. *To face p. 118.*





Camellia Sasanqua. *Cloranthus Inconspicuus*

Leaves used in the Adulteration of Tea.

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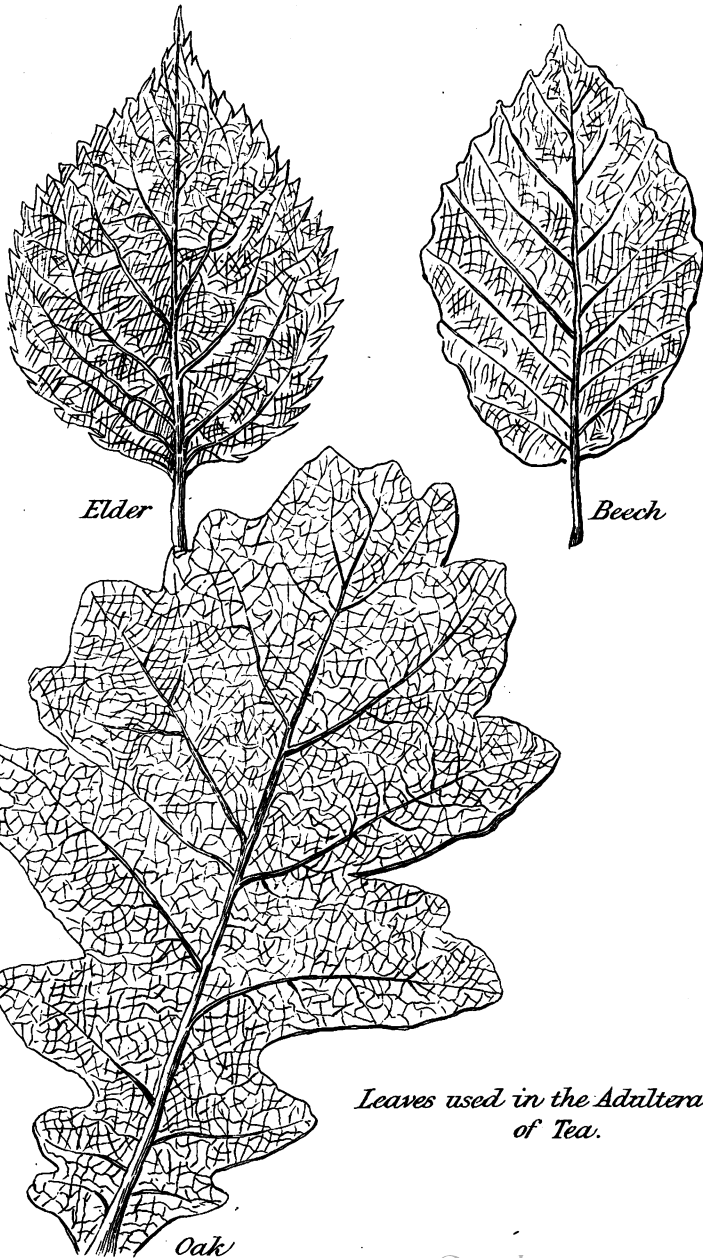

Leaves used in the Adulteration of Tea.

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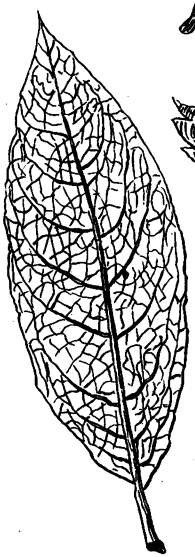
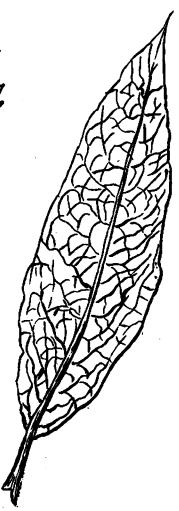
Sloe

Sloe

Hawthorn



Willow



Willow

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Brown sugar should be—

1. Light coloured.
2. Large grained.
3. Very dry.
4. Inodorous.
5. Should not stain paper if left in it for several days.
6. Entirely soluble in water.

Large grained sugars can not be "handled" or mixed, whereas small grained dark sugars may be readily mixed with starch sugars or glucose.

There should not be more than 5 per cent. water in raw sugar, nor more than 2 per cent. in refined sugar.

Sand may be readily detected by simple solution of the sugar and filtration.

The quality of sugar supplied in England for use of the Army and Navy is "brown cane sugar"; it loses weight to the extent of from 1 to 3 per cent. from evaporation when lying long in store.

Salt.

Salt occurs in nature principally in two forms—

1. As rock salt.
2. Salt as found in various inland seas, salt lakes, pools, marshes, &c.

Culinary salt is prepared from both these sources. In the case of rock salt it is first dissolved in water in order to get rid of impurities; artificial heat is then applied to evaporate the water and cause crystallization.

If the salt occurs in the solution in the proportion of 20 parts salt to 100 of water, artificial heat is at once applied to evaporate the water, but, if the salt occurs in a less proportion, natural evaporation is allowed to take place previous to the application of artificial heat.

The occurrence of salt in larger or smaller crystals is entirely due to the effect of temperature.

The salt water to be evaporated is placed in shallow pans, with a furnace at one end. The finest salt is deposited near the furnace, the coarse, or "bay salt," is deposited at the end furthest from the furnace, while an intermediate variety, known as "kitchen salt" is deposited in the centre of the pan.

Good salt should be—

1. Fine grained.
2. White.
3. Dry.
4. Entirely soluble in water.

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Pepper.

The pepper of commerce is furnished by the plant "Piper nigrum," which grows principally in the islands of Malacca, Java, Borneo and Sumatra. It is a climbing plant, growing to a height of from 8 to 12 feet. The berries or "peppercorns" are first green, then red, when they are gathered, and the stalks being separated by hand, the berries are dried.

Black and white pepper are both obtained from the same berry: black pepper being obtained by grinding the entire berry, while the white pepper is obtained by removing the outer coating previous to grinding. Good peppercorns should sink in water.

The substances commonly used for the adulteration of pepper are linseed meal, mustard husk, wheat flour, pea flour, sago, rice flour, and pepper dust. Formerly it was not uncommon to meet with artificial peppercorns, composed of oil cake, common clay and cayenne pepper.

The presence of spurious peppercorns may be detected by soaking for some time in water, when they will gradually break up and disintegrate.

Sand is a common adulterant. It, of course, influences the weight of the ash, which should never exceed 7 per cent.

Mustard.

Mustard is made from mustard-seeds, finely dressed. The manufacturer reduces the seeds to powder, and passes the product through a series of sieves. The portion in the first sieve is called the dressings, that which passes through is an impure mustard flour. The impure flour, on being passed through a second sieve, yields the pure flour of mustard, and a second quantity of dressings. The dressings are utilised by being submitted to pressure for the sake of the oil they contain.

The adulteration most commonly met with is a mixture of ground mustard with wheat flour, and coloured by turmeric. Other substances fraudulently mixed with mustard are: cayenne pepper, ginger, gamboge, potato starch, pea flour, yellow ochre, chromate of potash, plaster of Paris, and clay.

A microscopical examination is required to detect most organic adulterations. If, on the addition of iodine to an infusion of the mustard in hot water, no blue colour is produced, it is certain that neither wheat nor any other starch is present.

Good mustard is known by its sharp acrid smell and taste

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Milk.

Cow's milk has a specific gravity of from 1·030 to 1·034, and the cream amounts to about 10 per cent.

The specific gravity of milk is ascertained by means of a lactometer; if water has been added, the specific gravity falls nearer to 1,000, according to the quantity of water added.

The abstraction of cream without the addition of water will increase the specific gravity, so that, as well as testing with the lactometer, the cream jar must be used to ascertain the percentage of cream: this should be from 10 to 12 per cent., but never under 8 per cent.; the milk should be allowed to stand for 24 hours.

On service it would probably be impossible to keep the milk for 24 hours; in that case the formation of cream can be hastened by adding a large quantity of warm water; this does not augment the quantity of cream. Any glass jar divided into hundredths, or, if to be done roughly, into tenths, will suffice.

The examination of milk by means of the lactometer and the cream jar is very simple, and usually sufficient for all ordinary purposes.

Butter.

The colour, taste, and odour of the sample should be noted. The common adulterations of butter are the admixture of fats, other than butter, and of water, the latter being either left in the butter in undue proportion through faulty manufacture, or fraudulently added. The presence of added fat may be detected by ascertaining the exact temperature at which the suspected material will melt. Genuine butter melts at from 94° to 97° F. A lower melting point than this indicates butterine, and a higher melting point indicates the probable presence of lard or dripping, or of some other animal fat.

To detect the adulteration of added water, melt the butter, pour it into a bottle, place the bottle by the fire and let it remain there until the water and salt have, from their superior weight, fallen to the bottom. The amount of real butter contained in the specimen will, of course, be seen floating at the top. Out of 100 parts of butter there should only be 10 parts of water, and 2½ parts salt.

The rare adulteration of any other substance such as starches, &c., by mechanical admixture, cannot fail to be detected by the microscope. The following is a simple test for discovering the addition of fats:—A bit of wick is inserted into melted butter, lighted, and then blown out. If the butter is pure, there is little odour; but if artificial, a strong tallow-like smell is at once perceived.

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Rice.

The whole grain, deprived of the husk, is sold as rice. There are many varieties, of different colours and composition. As an article of diet it is extremely digestible, but is not nearly as nutritious as the produce of other grains. It is extensively cultivated in India, China, West Indies, and America.

Rice is said to be adulterated from time to time with other starches, but it is in itself so cheap that it is more likely to be used as an adulterant than tampered with.

If a sample is examined under a microscope any foreign matters can be easily detected.

The grains should be whole, clean, without grit or spots or evidence of insects; the larger grains are usually the most valued.

The broken rice is ground into flour and used for various culinary purposes, and also, being cheaper, for adulterating wheaten flour. It is also sold as "Cones-flour" for dusting dough, &c.

New rice is regarded as inferior in quality to old; the quality of ground rice is determined by its colour and thickening properties.

Arrowroot.

The chief kind is obtained from the maranta palm, a native of the West Indian Islands. Its quality is judged by its whiteness, by the grains being aggregated into little lumps, and by the jelly being readily made, and being firm, colourless, transparent, and good tasted.

Potato starch is sometimes sold in the market, so white and crackling, and making so good a jelly that the microscope must be used to distinguish it from arrowroot. If boiling water is poured upon potato starch, it produces a smell like that of raw potatoes, from which genuine arrowroot is entirely free, being inodorous.

Arrowroot is sometimes adulterated with wheaten flour; this fraud can be easily detected by pouring a little nitric acid on a small quantity of the adulterated mixture. If wheat flour be present, the particles of this flour will turn a bright orange yellow, but the colour of the pure arrowroot will not be affected.

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Tapioca.

Tapioca is a starch furnished by the manihot plant, which is more or less altered by heat, having been dried on hot plates. This causes some of the granules to swell, and thus renders indistinct in some cases the original structure. The starch is in groups of two to eight, or in isolated granules, which, owing to the drying to which they are subjected, renders them difficult of solution in cold water. In boiling water it swells up and forms a viscous jelly-like mass.

Tapioca is adulterated with the less costly flours of potato, wheat, and sometimes sago. When dressed in powder, it resembles sago meal.

The artificial tapioca, made with gum and potato starch, is in larger granules, whiter, more easily broken, and more soluble in water than the genuine.

The appearance of the starch grains is distinct from those of potato flour, the concentric rings being broken and irregular.

When adulterated with wheat flour, the latter substance may be detected in the manner described in "Arrowroot."

Sago.

Sago is the pith of certain species of palms. Granulated sago is either "common" or "pearl," the latter is chiefly used in hospitals.

Pearl sago occurs in small, hard, horny, semi-transparent grains, about the size of a pin's head, inodorous, and having little taste. The grains absorb water readily, although so hard, when dry, as not to be easily broken with the teeth.

Common sago occurs in larger grains, about the size of pearl barley.

Adulteration.

Potato flour, manufactured into grains, is sometimes sold for sago.

If boiling water be poured over genuine sago little or no smell will be produced, whereas, if poured over potato flour, the odour of raw potatoes will be readily distinguished.

The shape of the starch grains of sago differs considerably from those of potato, the particles of the latter being more distinctly ringed, smoother, and less broken than those of genuine sago.

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Cocoa.

Cocoa is made from the seeds of the cacao tree. It is extensively grown in Central America and some of the West Indian Islands. The cocoa-beans lie in the fruit. The cocoa-bean of commerce is brittle, of a dark brown colour internally, and eats like a rich nut. Before using, it is gently roasted in the same way as coffee, to develop the aroma.

"Cocoa Nibs" are the roasted beans deprived of their husk and crushed into fragments.

Cereal grains, starches, arrowroot, sago, or potato starch and sugar are very commonly mixed with cocoa. The presence of starch-grains of cereals, arrowroot, sago, or other kinds of starch is at once detected by the microscope. Sugar can be detected by the taste and by solution.

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Section VI.

MISCELLANEOUS.

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TABLE showing generally the Organization for the Supply of an Army in the Field, and the Organization of its Line of Communications.

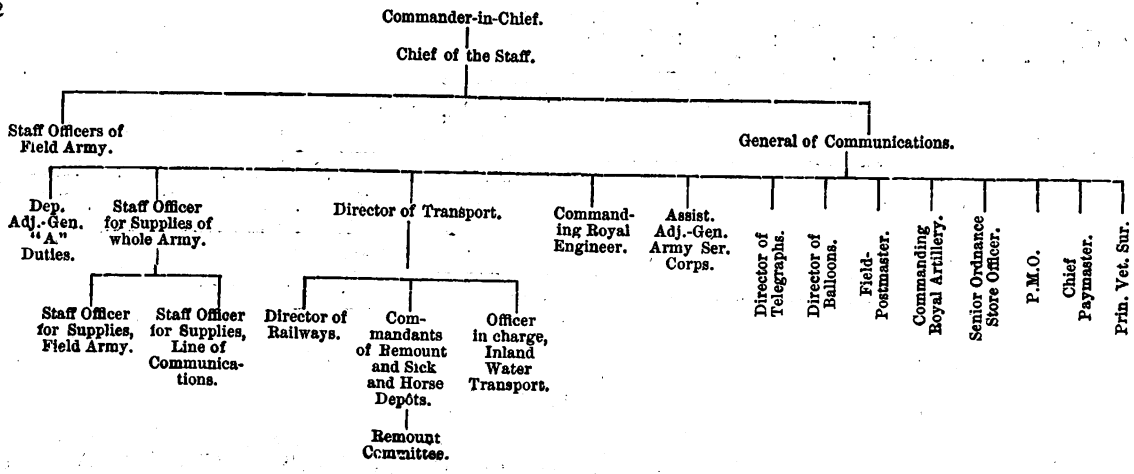

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TABLE showing more particularly the Organization for the A.S.C. Duties (Transport Executive Duties only) with an Army Corps and one Cavalry Division in the Field.

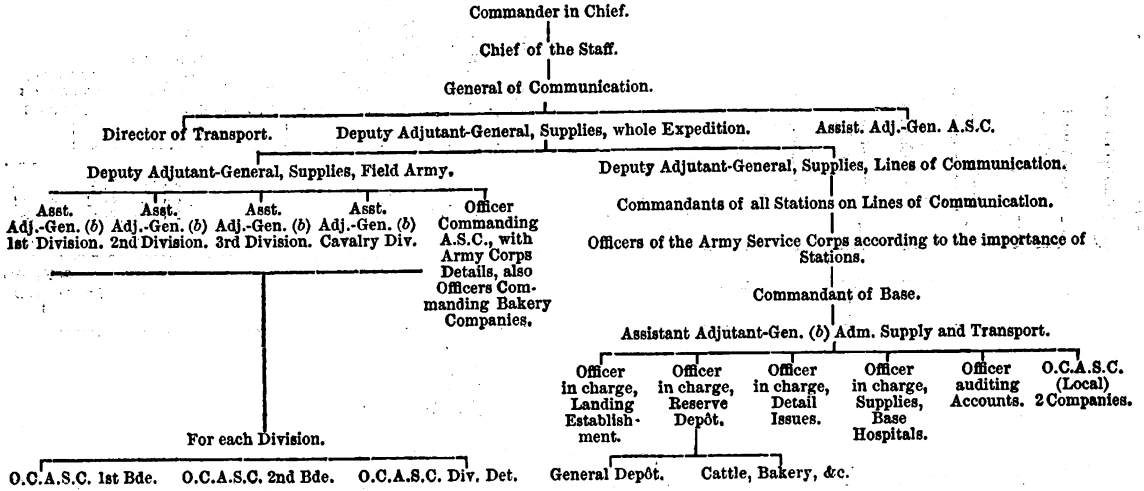
Commander in Chief.
Chief of the Staff.
General of Communication.
Director of Transport.
Deputy Adjutant-General, Supplies, whole Expedition.
Assist. Adj.-Gen. A.S.C.
Deputy Adjutant-General, Supplies, Field Army.
Deputy Adjutant-General, Supplies, Lines of Communication.
Asst. Adj.-Gen. (b) 1st Division.
Asst. Adj.-Gen. (b) 2nd Division.
Asst. Adj.-Gen. (b) 3rd Division.
Asst. Adj.-Gen. (b) Cavalry Div.
Officer Commanding A.S.C., with Army Corps Details, also Officers Commanding Bakery Companies.
Commandants of all Stations on Lines of Communication.
Officers of the Army Service Corps according to the importance of Stations.
Commandant of Base.
Assistant Adjutant-Gen. (b) Adm. Supply and Transport.
Officer in charge, Landing Establishment.
Officer in charge, Reserve Depôt.
Officer in charge, Detail Issues.
Officer in charge, Supplies, Base Hospitals.
Officer auditing Accounts.
O.C.A.S.C. (Local) 2 Companies.
For each Division.
O.C.A.S.C. 1st Bde.
O.C.A.S.C. 2nd Bde.
O.C.A.S.C. Div. Det.
General Depôt.
Cattle, Bakery, &c.

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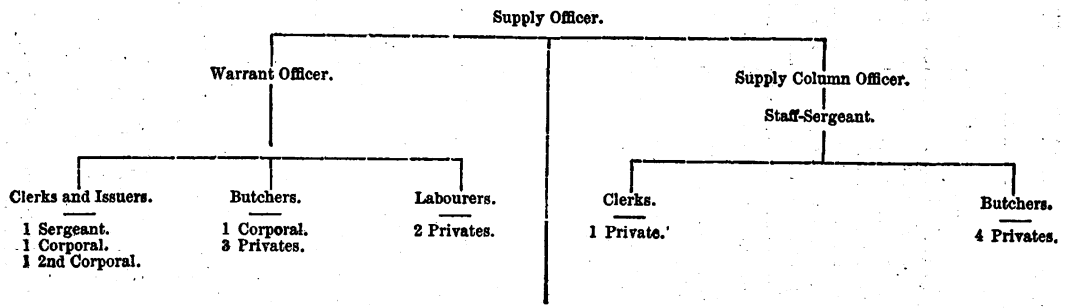
TABLE showing the Distribution of Duties between the Supply Det. A.S.C. with a Brigade of the Field Army.



Bakers.—For section of 10 Ovens (if with Brigade).

Masters	2—1 Sergeant, 1 Corporal.
Foremen	2—Privates.
1st hands	2—Privates.
2nd hands	5—Privates.
2nd or 3rd hands ...	5—Privates.
2nd hand	1—Private, Cook.
Foremen	1 Corporal, 1 Private, Brewers.

Enough calculated for requirements of a brigade as above, it must be remembered that Field Bakery Companies are "corps troops," and form no integral portion of Divisions or Brigades.

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DUTIES OF OFFICERS ON ACTIVE SERVICE.

Officer Commanding Army Service Corps.

An officer, to be called the Assistant Adjutant General for the Army Service Corps, will be appointed to the Staff of the General of Communications, and his office will be at such a place as the latter may direct.

He will correspond direct with officers of the Army Service Corps on all subjects relating to the interior economy of the corps; but all reports from, and all instructions to, officers of the Army Service Corps on other matters will be sent through the officer under whom those officers are serving.

He will be in the position of an officer commanding a regiment, as regards the whole of the Army Service Corps with the Army, and orders for the movement of parties of the Army Service Corps will be issued by him. When, from the exigencies of the Service, this is not practicable, and they have to be moved without reference to him, the particulars of the move should be at once reported to him by the officer ordering the movement.

Officer in Charge of Landing Establishment Base.

This officer's duties are defined in Sub-Section XVI., Section II., Regulations for A.S.C. Duties.

Officer in Charge of Reserve Base Depôt.

He will receive and take charge of all A.S.C. supplies landed for the use of the Army, and of the miscellaneous implements and stores for use by the A.S.C., and will be responsible that they are properly protected from the weather.

He will push forward supplies to the front by every means that may be available, under orders from the Staff Officer at the base, sending in daily states of the quantities of supplies and stores which have been received, issued, and remain.

He will see that all supplies and A.S.C. stores landed agree and are taken on charge in accordance with the bill of lading. Any discrepancies should be noted on the bill of lading before it is signed, and returned to the master of the vessel or the consignor.

He will issue in bulk only, striking off by way-bill all articles forwarded to other accountants.

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Officer in Charge of Detail Issues at the Base.

For the purpose of making detailed issues to troops not forming part of the Army Corps organization, a separate Supply Establishment is assigned and is composed of a Major and a specified Staff.

The detail of troops to be left permanently at the base is laid down in a general way in Table 64, Field Army Establishments, Service Abroad, 1891, and would probably amount to 5,000 men and 1,200 horses under the conditions therein stated.

The supply officer will render such states, &c., as may be required to the Staff Officer at the base.

The duties of this establishment do not call for any special remark, being conducted on a similar principle to that of any large station at home.

Officer in Charge of Accounts.

See Regulations for A.S.C. Duties, Section II.

This officer will forward any queries which may arise on the accounts to the different accountants for explanation, and will send home their replies with the accounts.

Alterations in vouchers or accounts received by this officer are not, under any circumstances, to be made by him.

Any adjustment consequent on the examination of the accounts, must be made by the accountant concerned, who will quote on the adjusting voucher the "observations" on which it is based, and, in replying to the observation, will give the number and date of such voucher.

The following accounts and returns will be rendered from each brigade and depôt to this officer :—

(1) Supply Account.
(2) Equipment Ledger.

A.S.C. Officers in Charge of Stations along the Lines of Communication.

Under the orders of their commandants they will be responsible—

1. For the supply of all troops stationed at or passing through their stations.
2. For the efficiency of the station transport.
3. That all available transport is utilized to the utmost in forwarding supplies, and that all empty wagons or unemployed animals are sent to the rear for more.

Supplies are to be drawn from the depôts or stations in the rear, or are to be obtained by purchase and requisition from the surrounding country, as may be ordered.

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The quantities shown on a way-bill should invariably be entered as received, and any deficiency should at once be written off. The attention of the conductor should be called to any discrepancy.

Convoys of supplies passing through on consignment to another officer are not to be brought on charge or interfered with.

The station commandant should at once be informed whenever the supplies fall short of the reserve ordered to be maintained. Daily States will be furnished to him of supplies received, issued, and remaining.

Returns, &c., from Brigades and Stations along the Lines of Communication.

The following returns will be prepared by A.S.C. officers in charge of brigades and stations or depôts along the lines of communication, and will be furnished to officers commanding brigades and stations:—

1. A three-daily state of supplies (A. Form F 761) showing the quantities received, issued, and remaining in store on the 3rd, 6th, 9th, &c., 27th, and last day of each month. On the back of this return should be noted the number of troops present at the station, and the quantities and prices of supplies which can be procured locally by purchase or requisition.

2. A weekly state of transport, on Army Form B 74, showing the number of effective wagons, carts, animals, and drivers present, together with the casualties which have taken place since last return, and the date and authority for appointments and discharges.

3. The numbers only of non-commissioned officers and men, labourers, drivers, and herds will be included in this return.

4. On 1st of each month, a schedule of all special A.S.C. purchases made, and services entered into during the past month, giving dates upon which bills were forwarded to General Officer Commanding.

5. On 1st or each month a return of all hired buildings and farms in occupation, showing the alterations since last return.

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DUTIES OF SUPPLY OFFICER, ARMY SERVICE CORPS, WITH AN INFANTRY BRIGADE.

The Army Service Corps Company, with an Infantry Brigade, is distributed as follows:—

	Supply Officers' Equipment.		Staff of Bgde. Head Qrs. of Company. Bearer Compy. and Fld. Hsptl.		Supply Column.		Supply Column. Emergency Ration.	
	Supply.	Transpt.	Supply.	Transpt.	Supply.	Transpt.	Supply.	Transpt.
Officers and men:—								
Officers	1	—	—	2	—	1	—	—
Warrant Officers	1	—	—	2	—	1	—	—
Staff Sergeants and Sergts.	1	—	—	5	1	2	—	—
Corporals	3	1	—	5	—	1	—	1
Artificers	—	—	—	18	—	4	—	—
Buglers	—	—	—	2	—	—	—	—
Drivers and Privates ..	5	6	—	87	5	39	—	6
	11	7	—	121	6	48	—	7
Total, all ranks, including 1 Veterinary Surgeon attached				201				
Horses:—								
Officers' (private) ..	2 (includes Veterinary Surgeon's horse)							
,, (public)	—	—	—	2	—	1	—	—
Riding	1	—	—	14	—	3	—	—
Draught	8	—	—	128	—	70	—	12
	11	—	—	144	—	74	—	12
Total, all kinds				241				
Wagons and Carts:—								
Carts { Forage (2-horse) ..		1		2		1		—
Carts { Water (2-horse) ..		1		—		—		—
Wagons { G.S. (4-horse) ..		1		5		17		3
Wagons { Forge (4-horse) ..		—		1		—		—
		3		8		18		3
Total Vehicles				32				

The strength of an Infantry Brigade on the present War Establishment for which rations will be procured by the officer in charge of supplies:—

Officers	131
Men	4,222
Total	4,353

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Horses :—		
Private	43	
Public Riding	31	
Draught	456	
Pack	12	
Total	542	
Total Carriages with Brigade :—		
Carts, Forage (2-horse)		13
Small Arm Ammunition Carts (2-horse) ..		17
Carts, Water (2-horse)		4
Forge Wagons (4-horse)		1
Ambulance „ „		10
G.S. Wagons „		78
Total		123

Supply and Transport of Brigade.

The supply and transport requirements for a brigade are provided for by an executive officer, captain Army Service Corps, who is attached to the staff of the general officer commanding the brigade to whom (through the brigade major, or otherwise, as may be ordered) he is responsible for the supply of provisions, forage, fuel and light, and for the transport of his brigade. The supply and transport column of a brigade is formed of one company of the A.S. Corps. This company provides :—

1. The whole of the organization for collecting and issuing rations and forage to the brigade.

2. The arrangements for shoeing, and the veterinary supervision of the brigade.

3. The transport for the baggage, &c., of the brigade staff, bearer column, field hospital, and of its own men, on the same scale as is carried with the battalions.

4. The transport, &c., for the brigade supply column :—

Pages 10 and 11, Field Army Establishments, Service Abroad, 1891, show the number of days' rations, forage and fuel to be taken with brigade, and how they should be carried.

Of the two captains, Army Service Corps with a brigade, the senior is the responsible officer for all supply and transport arrangements. He also is more immediately responsible for the branch, either supply or transport, to which he for the time belongs. The other captain is more immediately responsible for the other branch. We have therefore one officer performing transport executive duties, another supply executive duties, and the senior of the two generally supervising and being responsible for both.

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The distribution of the company for transport duties is laid down in Field Service Manual, A.S.C., Table I, and need not be further alluded to here.

All regimental transport is in the hands of officers commanding corps, and works under their direction, but when this transport is unemployed, it may be utilized for general service as the G.O.C. may direct.

For supply duties the officer has the following assistance :—

Superintending warrant officer, 1 ; clerk, 1 ; issuers, 2 ; butchers, 4 ; labourers, 2 ; staff-sergeant for 1st line, supply column, 1 ; issuer for ditto, 1 ; butchers (as drovers), 4.

For supply columns emergency ration, 2nd corporal (transport).

Bakery section (10 ovens) when ordered to be attached to the brigade :—

1 sergeant ; 1 corporal ; 1 2nd corporal ; 16 bakers.

The following distribution of the subordinate staff for supply duties is that generally recommended.

The superintending warrant officer is responsible to the officer in charge for :—

1. The equipment laid down in the F.S. Manual, Army Service Corps, Appendix VI, page 49, which he should distribute to the master-butcher and issuers according to their requirements. He should see that every article is duly entered in the equipment ledger, and that this account is properly kept up.

2. The stationery and forms, office furniture, &c., laid down in Appendix VII, F.S. Manual, A.S.C., page 73. The former being calculated to last 3 months only, he should see that they are economically used and kept in the boxes to which they are allotted in the table, so that they may be readily found when wanted.

3. The packing of the G.S. wagon. He should see that this is systematically packed on every occasion of a brigade move ; that the articles likely to be required for immediate use on arrival at the camping ground are put in last, so as to be readily got at when required, and that special precautions are taken for the protection of those likely to be injured when proceeding over rough ground.

4. The receipt of supplies. On the arrival in camp of any supplies intended for his brigade, he should take steps, if possible, to have them quickly unloaded, examine their condition and, if consigned on way-bill, compare the quantities with that document. If correct, initial way-bill (triplicate), and pass to officer in charge for his signature, or, in his absence, sign on his behalf.

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If the quantities are correct they should at once be entered in the magazine book, Army Book 44.

5. The issue of rations. He should superintend generally the daily issue of rations; see that the indents (Army Book 55), are sent in at the hour appointed; that they are properly checked, and that the issues are made correctly and to the satisfaction of the troops.

6. The stock of supplies. He should be able at all times to keep the officer informed as to the stock of supplies on hand. He should prepare for his signature the necessary requisitions on the advanced depôt, or other source from which supplies are obtainable.

7. The supply office routine. He should make himself thoroughly acquainted with the system of field accounts as laid down in the regulations for A.S.C. duties, and carefully supervise the clerk's work; never allow the magazine book to be a day in arrear; see that all returns required to be rendered are ready for signature by the proper date, and that the supply account is kept up to date and ready to be closed at the shortest notice.

Clerks.

One clerk is allowed for the brigade supply officer, and his classification should be at least "3rd grade." He is responsible under the direction of the superintending warrant officer—

That the magazine book is kept up daily.

That the demands for rations (A.B. 55) are checked as early in the day as possible.

That the schedule of rations, F 751, is completed and entered in the magazine book daily.

He further assists generally the warrant officer in the preparation of all returns and accounts.

Issuers.

Three N.C.O's., sergeant, corporal, and 2nd corporal are allowed for a brigade as clerks and issuers. The supply officer therefore, having selected from these the one best suited for clerical work, assigns to the other two the duties of issuers. The issues should be definitely fixed between them, one for bread stuffs, preserved meat, groceries, &c., the other to issue forage and wood.

If the bakery is on the spot, the master baker would issue the bread direct, if not, it would be issued like other supplies through the issuer.

The butchery being always with the brigade, the meat would be issued by the master butcher at the place appointed.

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Butchers.

The establishment of butchers for an infantry brigade is fixed at 1 corporal and 3 privates (with 4 privates for the supply column) Table VIII[a] F.S.M., A.S.C.

The master butcher, with his foreman and two other butchers (1st hand and 2nd hand), are responsible for the custody of the cattle, for their slaughter, and for their issue to the troops. The four privates assigned to the supply column, when not employed as cattle drovers, are available for general duties, or to assist the master butcher.

Labourers.

Two men are told off as labourers for general fatigue duties, to assist unloading wagons and to help issuers. Occasionally they must be helped by fatigue parties.

General Remarks.

The vehicles for supply officer and his equipment are:—
1 G.S. wagon, 1 forage cart, 1 water cart.

The wagon contains baggage, rations, tarpaulins for protecting supplies from the weather; miscellaneous stores, such as axes, spades, lanterns, weighing machines, bullion bags, distinguishing flags, &c., &c., in fact all that is necessary in the way of stores and implements for receipt and issue of rations, and for conducting an office.

The forage cart contains the butchery implements, weighing machines, butchers' working clothing, &c.

The water cart is for the butchery. The supply column has 17 G.S. wagons for provisions, forage, and fuel for brigade for 1 day. Pages 10 and 11 of Field Army Establishments Service Abroad, 1891, detail what the transport has been calculated to carry, and the number of days' provisions and forage the brigade will march with.

A specimen loading table is shown on page 106 of F.S.M., A.S.C. It will be found difficult in practice to adhere strictly to this principle; but the articles should certainly be so far distributed that if a wagon or two were captured by the enemy, the brigade would not be entirely without any one article.

General Duties of Supply Officer.

The duties of the A.S.C. officer in charge of supplies of a brigade may be summarised as follows :—

He is responsible for the supply of provisions and forage for his brigade.

At the end of the month he will close and forward accounts to the officer deputed to audit them.

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Should the brigade be halted for a few days, every opportunity to ascertain the resources of the surrounding country should be taken advantage of.

When directed he will obtain the supplies for his brigade by purchase or requisition from the country through which the brigade may be marching, instead of drawing them from the depôt.

Supplies thus obtained will be credited in the supply account, care being taken that each entry exactly agrees with the receipts given on the separate bills for payment, and that the quantity is initialled in the magazine book.

He will be responsible that the stated supplies are always carried with the brigade.

In the field, when purchases are intended to be made by the A.S.C. officer in charge of supplies and paid for by him, the paymaster advances a sum of money on "Imprest." An imprest account would then be opened by the supply officer. This is a simple Dr. and Cr. account with the paymaster; each item of expenditure must be properly vouched for, *i.e.* if 5,000 lbs. of meat are purchased, the proof of payment would be the receipted bill, and at foot thereof it would be certified that the quantity of beef had been brought to credit in a specified A.S.C. supply account.

Staff-Sergeant for Supply Column.

This S.S. accompanies and remains with the supply column on all occasions, taking charge of the contents of the wagons, and accounting for them. When sent to convey supplies from any given source he takes with him the requisition for such supplies, receives them over at the place appointed, and signs the way-bill for same; on return to camp he hands them over to the officer in charge or superintending W.O., and obtains the necessary receipt to triplicate way-bill, which he retains.

Issuer for Supply Column.

This issuer simply assists the S.S. for supply column.

Supply Column.

The regiments and corps of the brigade should have with them certain reserves as laid down in F.A. Estab. (3½ days' supply), and, in addition, the brigade supply column carries one day's complete rations for all men and animals, and a supply column emergency ration.

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It devolves upon the brigade supply officer to replenish this stock daily. Bills for supplies obtained by purchase or requisition on the inhabitants, before transmission to the paymaster, are countersigned by the G.O.C., the division, who reports these purchases to the D.A.G. of the Army Corps in his monthly Schedule F 740.

The supply column is a distinct portion of the company A.S.C. as shown in the tables. It consists in the case of an infantry brigade of 19 wagons (17 wagons and 1 forage cart), under the command of a subaltern officer, who is responsible to the brigade supply officer for the conveyance of supplies between the advanced depôt (or other source), and the locality of the brigade. The supplies, however, are obtained upon requisitions presented by the Staff-Sergeant who accompanies the column as the representative of the brigade supply officer, and who is assisted by the issuer and 4 cattle drovers before mentioned.

The supplies, when brought into camp by the supply column, are off loaded at a spot fixed by the brigade supply officer, from whence they are issued to the troops in the evening as a rule, or whenever practicable at other times, the troops bringing their regimental transport for this purpose at the hour laid down in brigade orders.

The management of the brigade supply column is simple enough when the brigade is halted, as a fixed system can be laid down and adhered to; but when the brigade is marching the supply officer must be guided in his arrangements by the times and lengths of the marches, the supplies he can obtain in the vicinity, and the safety of his communications.

The foregoing remarks on the replenishment of supplies apply equally to supply officers with army corps details, divisional details, and cavalry brigades.

CHECKING SUPPLY ACCOUNTS.

In checking supply accounts the following points must always be attended to personally by the officer in charge of supplies:—

1. Never to sign a bill without first placing his initials against the entries in the magazine and bill books.

2. Never to sign a receipt or issue voucher without

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inserting his initials in the magazine books of receipts or issues.

3. Always to check bills as described on page 145.

4. Always to see that the remains from the previous month, in the magazine book of receipts, tally with those brought forward in the current month.

5. See that the totals of issues are correctly brought over and deducted from the total receipts and remains.

6. Take a few vouchers at random, and see that their totals have been correctly entered in the magazine books.

7. Compare every figure on the abstract of account which goes to the War Office, with the entries in the magazine books, of which it is a copy.

8. See that all the vouchers are put up with the abstract, or account for any deficient ones.

9. Lastly, take stock monthly and ascertain that the total book remains agree with the remains actually found at stock-taking.

GENERAL CONDITIONS OF CONTRACT, &c.

Contractors are to reside at the places of supply, or appoint an agent who is subject to the approval of the officer under whose authority the contract is made. Such agent is subject to be removed or replaced on notification from that officer to the contractors.

Contractors' accounts are to be furnished on Army Form P. 1920 for general supplies, and on Army Forms P. 1931 and P. 1932 for hospital and prison supplies. All such claims must be preferred within one month after the last day of the month in which the supplies may have been furnished.

Payment will be made to contractors, subject to any deductions that may arise in consequence of a purchase in default, &c., by the district paymaster or the Accountant-General.

Contractors are liable to forfeit and pay a sum of not less than £5, nor more than £100, for every act of which they may be proved guilty of bribing or treating any person, civil or military, employed under the Secretary of State for War.

Contracts will be terminable by the Secretary of State for War, by giving due notice in writing to the contractor

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to that effect, in the event of the contractor's insolvency, or in case of its being proved that he has been guilty of bribing or treating.

Contracts shall not be sub-let without the permission of the Secretary of State for War.

All orders upon contractors for supplies should invariably be in writing.

When the contractors fail to supply articles for which they are responsible as contractors, and for which the usual Army Service Corps order has been sent them; or when the articles supplied are of an inferior quality, and not in accordance with conditions of contract as specially laid down for the supplies to which such conditions apply; or when the supplies tendered fall short of the quantities ordered; the officer in charge of supplies, or officer acting for him, is empowered to make purchases in the contractor's default, any extra expense involved being chargeable against the contractors.

Securities for the performance of contracts are not usually demanded at home stations unless the contractors are in possession of Government stores, when they must invariably be obtained. The amount should (as a rule) be equal to the value of the largest number of articles likely to be in the hands of the contractors at one time. In other cases, where security is deemed advisable, special instructions will be sent from the War Office.

The staff officer (b) will be specially informed when supplies are obtained by other means than by local contract.

Contractors should keep the stipulated reserve in store.

In calling for tenders care will be taken that forms are issued to all persons considered eligible and likely to tender, always including present or former competent contractors.

Particulars of all contracts should be sent to district paymaster, and the authority for entering into contracts should be stated on the bills furnished to the paymaster for any supplies received under their conditions.

Field Service.

When the nature of field operations admits of the system laid down for general contracts being resorted to, this course should be adopted.

As a rule, however, this would only be practicable at the base or stations on the lines of communication.

For the army corps, divisions, and brigades, a system of temporary contracts may sometimes be feasible, in

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which case a memorandum of agreement (Army Form F. 712) would be the form used, thus :—

Army Form F. 712.

MEMORANDUM of agreement entered into this _____ day of _____, 189 , between _____ on behalf of the British Government, on the one part, and _____ on the other part.

The said _____ hereby agrees to supply the British Troops quartered at _____ with the following articles, in such quantities as may be demanded, for a period of _____ commencing _____ and ending _____ at the undermentioned rates, namely :—

ARTICLES.	RATES.

The quality of the articles to be good, and subject to the approval of the , or office authorised to act on his behalf.

Payment to be made monthly in _____ on the production of receipts from the proper officer.

, his successor in office, or _____, shall have the power to terminate this contract on giving _____ months previous notice.

Dated at _____ this _____ day of _____ 189 .

Witness _____ Signature of } _____

Witness _____ Signature of Contractor. } _____

(Special Conditions, if any, to be added at back hereof.)

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The same form can, of course, be used equally for contracts at stations on the line of communication when circumstances preclude the ordinary system being carried out.

In all cases, however, where this form is required care should be taken to insert such conditions on the back as will ensure the contracts being effectually carried out, such as specifications of the quality of the various supplies, a clause to enable purchases to be made in default, and another to make the decision of a Board of Officers final.

In some countries the exaction of fines may have greater effect, but the supply officer would be guided in any case by local customs.

BILLS.

The forms upon which bills are preferred are as follows:—

Army Form P. 1920, for general supplies.
" P. 1922, for services performed.
" P. 1931, provisions for hospitals and prisons.

For existing contracts, the No. and date of the Report to War Office, or of the War Office letter authorising the contract, must be quoted on each bill. The supply officer in signing the bill certifies that the supplies described have been delivered in accordance with the terms of contract, and will be credited in the provision store account for the month in which the articles were supplied.

Mode of Checking Bills.

1. See that the amount of each article charged for agrees with the quantity brought on charge in the magazine book, and initial the entry of each article.
2. See that an entry of the bill is correctly made in the bill book, and initial the same, taking care that the same bill has not been entered before.
3. See that the price charged is the proper contract rate
4. See that the computation is correct.
5. See that the total in words agrees with the total in figures. Draw lines across blank spaces for the amount in words and figures.
6. See that the bill is sent to you by the contractor on the proper form, and has not been made up in your office, except when specially ordered. It must be signed and dated by the contractor.

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7. See that the bill is not detained in your office more than the necessary time for verification. In some instances bills are made out against advances previously made to contractor to enable him to carry out his contract. In such cases it should be shown on the face of the bill in red ink "against advances."

8. See that the quantities of supplies charged for have been delivered, and are so shown in your office records of receipts by storekeepers, &c.

9. Lastly sign and date the bill, and pass for payment—

For amounts of £100 and upwards pass { At home—to the Accountant-General, War Office. Abroad—to District Paymaster.

For amounts under £100 pass to the District Paymaster.

When sent to the district paymaster, a confidential schedule (Army Form P. 1964) detailing the bills should be sent in a separate envelope marked "Confidential." Officers should initial each entry on this schedule before signing bills.

Bills should be ready for payment not later than the 10th of the month following that to which they refer.

Bills.—Special Purchases.

In cases of emergency, when time will not admit of obtaining supplies by contract, special purchases may be made under the orders of the General or other Officer commanding. Even in this case, if possible, tenders should be obtained, and the lowest accepted, a copy of which should be attached to bills passed for payment. The certificate at the foot of the bill, "in accordance with the terms of contract," should be struck out, and the words "and that the price is fair and reasonable, and the lowest obtainable" substituted. The bill should be headed, "No contract. Special purchase."

The account and tender are then passed to staff officer (b), who will schedule them with others of a like nature on Army Form F. 740. This schedule is signed by the General Officer commanding at the end of the month, and sent to the War Office. The staff officer (B) adds the following certificate to the bill :—

Approved will be found entered in the Schedule of Special purchases. division, brigade, command, &c., for the month of Item No.

It is then passed to the Paymaster for settlement.

Purchases in Default.

Supplies purchased in consequence of the default of a contractor will be credited separately in the magazine

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book, and will be paid for in the same manner as other purchases. Upon the bill for payment will be stated in red ink, "Purchase in default of contractor for ," and any excess of cost to be recovered from the contractor will be noted on the bill. A reference will also be made, when possible, to the bill upon which the amount is recovered. The contractor will be credited with and paid for the quantities actually received from him. From the amount due at the end of the month will be deducted on the face of the bill any excess of cost over contract rates which may have been incurred through his default (reference being made to the bills).

Warrant officers and non-commissioned officers in charge at out-stations should only make purchases in default under the orders of the officer commanding troops.

BILL BOOK (Army Book 223).

The particulars of each bill should be entered in this book—that is to say, the date of receipt from the contractor, the period of account, the name of the person to whom the bill is payable, the quantity and description of article supplied, the amount of the account, and the date when passed for payment; these particulars will be verified by the initials of the supply officer. This book is of the greatest importance, for the omission to enter a bill therein may involve a second payment for the same quantities, or a failure to discover that a particular purchase has been duly brought to credit in the magazine book of receipts. The officer in charge of supplies should therefore make it a rule never to certify a contractor's bill without first placing his initials against the entries in the magazine and bill books. The vote, and the item of vote, should also be entered on the top of each page of the bill book, to admit of the expenditure being easily ascertained.

A statement of expenditure up to the 30th September, under various heads, is to be recorded by the supply officer for preparing the estimates. It will greatly facilitate the preparation of this return if the bills are posted in the bill book under the following headings, which correspond with those of the items in the parliamentary estimates under—

Vote	A	....	....	Cost of provisions.
„	B	....	....	„ forage and paillasse straw.
„	C	....	....	„ „ fuel and light (on field service only).

Payments ordered under other votes will, in like manner, be shown separately under their proper headings

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Consignments and Way-Bills.

The authorized form of way-bills must invariably be used. When hired transport is used, care should be taken that the contractor understands and accepts the responsibility for loss or damage.

Conductors, or others, in charge of convoys or consignments, will require the consignee to at once satisfy himself that the articles they deliver agree exactly with the details as given on way-bill. Any difference will be made clear at once, and stated, as required on the back of the different copies of way-bill.

All incidents that may occur on the line of march, state of weather, swollen streams, state of roads, which may account for delays as well as casualities to men and animals, loss or damage of stores, should be entered by the conductor in a diary, which should be produced to all inspecting officers.

Instances may occur when, from a breakdown of conveyance or other unavoidable causes, parts of consignments may be ordered to be unloaded at another station than the one to which it was originally consigned; when such is the case, the contractor, agent, or conductor, must protect himself by obtaining a written order and receipt for the articles taken from him; this he will attach to the way-bill. Under no circumstances are the quantities originally consigned to be altered. They must remain on the conductor's charge, any deficiences being accounted for by receipt or otherwise.

The officer to whom the supplies, &c., were originally consigned will take on charge the full quantities as given in the orginal way-bill, writing off at once, by means of an issue voucher, any quantities off-loaded, or deficient from other causes, and supporting the debit by the receipt given at the intermediate station, the proceedings of board of survey, or copy of special report to his senior officer, under whom he is directly serving.

It must be clearly understood that no exception can be permitted to this rule.

The responsibility of tracing deficiencies and obtaining covering authority to deal with them, must, after receipt of report from the accountants, rest with the staff officer (*b*); he must cause the necessary inquiry to be made, and, as far as possible, arrange between the accountants, and fix the responsibility for the loss. When all information is obtained and further credits (if obtainable) are given, the entire correspondence will be forwarded to the D.A.G. supplies for the expedition.

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Employment and Payment of Civilian Subordinates, Native Drivers, Labourers, &c.

The senior officer of each brigade, division, station, or post, will keep an establishment book, in which the employment of all permanent subordinates, not organized into regular companies, must be recorded.

Casualty returns, showing the changes in the establishment, will be forwarded on the first day of each month by these officers to their next superior officer.

First appointments, rates of pay, and allowances of conductors, clerks, storekeepers, and interpreters, should be notified in general orders. Such men should be paid on the ordinary pay list. Each should be supplied with the pay certificate book mentioned in the following paragraph.

Drivers, labourers, herds, and others permanently employed with auxiliary transport, or at depôts and stations, should be formed into sections and companies for purposes of detail of employment. They will be paid on the usual pay list. Men of this class should, on their names being recorded in the establishment books, be supplied with a pay certificate book (Army Book 41, IV.), in which their names, description, rate of pay, dates, and period of engagement, should be filled in. The officer approving of the engagement must add his signature. These men will be paid weekly, monthly, or at periods most convenient, and to be decided upon by the Senior Army Service Corps Officer at the station.

Pay lists of all civilian employés should be prepared by the Army Service Corps officers, and the officers of the army pay department should be requested to make the detail payments to individuals. In cases where an officer of the army pay department cannot make the detail payments to individuals, the payment must devolve on an officer especially deputed by the Senior Army Service Corps Officer for pay duties. Should the officer under whom the men are serving be required to make the payments, he will invariably apply for another officer to attend to, witness, and certify to the payments.

No man should be brought on a pay list until he produces his pay certificate book. Both the first and each subsequent payment will be supported by the certificate from pay book, duly signed by the officer who engaged, or last paid, the individual.

When an employé ceases to serve, the officer under whom he last served will retain the pay certificate book, and forward it with the casualty return, in which the man is struck off the establishment. The reason for the man ceasing to serve should be stated in the book, and signed by the officer.

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Should the book be lost, a new one is only to be issued by special authority obtained from a senior officer after full report and enquiry.

Advances of pay will be fully stated on the next certificate, as also any fines or stoppages not settled.

Supply Duties in connection with Hospitals (on Active Service).

The medical organization for an army in the field consists of :—

(*a*) Two bearer companies for each division. A bearer company consists of 64 officers and men of the M.S. Corps, and its duties are to collect and succour the wounded during and after an engagement, to remove them to the dressing stations, and from thence, after their wounds have been dressed, to the field hospitals in rear. The transport of a bearer company, whether wheeled or pack, is furnished by the A. S. Corps, and is under an officer of that corps, whose duties are to superintend the movements of the ambulances and pack mules, and to afford every assistance in this respect to the medical officer in charge.

(*b*) A field hospital to each brigade, divisional detail and corps troops.

In field hospitals the patients are supplied with the ordinary field ration which is drawn direct by the M. O. from the supply officer of the brigade. On the day of admission, if the ration has been drawn regimentally, it should be sent (uncooked if possible) to the hospital, but if it is not, the patient must be subsisted under hospital arrangements.

This ordinary ration may be supplemented by medical comforts as may be necessary and available, the quantities of the latter being entered on Army Form F 736.

(*c*) General hospitals at the base, and stationary hospitals on the line of communications.

In these hospitals the scale of diets laid down in the Allowance Regulations, will be followed so far as practicable. Such hospitals are, as in the case of garrison dieted hospitals, supplied by indenting on the local supply officer, or on contractors direct.

When the cause for which a man is admitted into a field hospital is of such a nature that the patient can be discharged in a day or two he is kept there, but if longer treatment is required, the patient would be sent to the nearest stationary FP, from whence, if the case is serious, or likely to incapacitate the soldier from serving for a long period, he would be sent to the general hospital at the base, and thence, if necessary, home.

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Storage.

Nothing is more important in the field than storage. There should be sufficient storage at the base of operations and at all depôts along the line of communications to protect all perishable stores and supplies from the wet, &c.

If storage cannot be obtained on the spot by hire, or otherwise, storehouses will be erected at the base of operations, and no unnecessary reserves of perishable supplies are to be landed till protection is ready. These storehouses at the base of operations should be sufficient to hold at least two months' supplies for the force (both men and animals) which is intended to operate in the field.

Storehouses should also be erected at each main depôt along the line of communications sufficient to contain the reserves of supplies which are ordered to be kept at such depôt.

The earliest possible information should be given to the Royal Engineer Department of the requirements in this important matter.

As troops advance and depôts are pushed forward, it will often be necessary to form depôts of supplies at places where no storehouses have been erected, in which to shelter the supplies from the weather.

In all such cases tarpaulins will be sent with the supplies, and as soon as the latter are unloaded they will be properly stacked and covered over.

When supplies are to be stacked, a spot should be selected on a slight elevation in order to prevent the wet from settling under them, and a rectangle about 15 feet broad, and as long as may be convenient, should be marked out. The earth within this space should be levelled and banked up about 2 feet above the surrounding land, and on this the supplies should be stacked, taking care to put branches of trees, old timber, or layers of boxes of preserved meat, and other supplies impervious to damp, at the bottom. Rum should always be placed in the centre of the stack, and covered over to prevent improper access to it.

The supplies should be stacked in the form of the roof of a house, leaving open spaces for ventilation and for ready access, and the tarpaulins should then be drawn over them. If cross-poles can be obtained, on which to rest the tarpaulins, it will be all the better.

Supplies should never be stacked so as to have a flat surface at the top, as the rain is sure to settle on the tarpaulins and soak through into the supplies.

Trenches 2 feet deep should be dug all round the stack, and the water which may accumulate in these trenches should be drained away.

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On dry days the tarpaulins should be removed in order that any supplies which may have been damaged or wetted may be dried. Such supplies should be issued as early as possible, to prevent their further deterioration.

Packages.

Wooden cases will never be returned to the rear unless specially ordered; they will be used as fuel, and are admirably adapted for use in field ovens; they will not be brought on charge on field service.

Empty casks which have contained rum, porter, &c., should be sent, when opportunity occurs, to the rear in "shooks."

With every convoy there should be a supply of needles and twine to repair any sacks that may burst open.

List of Books kept in a large Supply Office.

Bill Book.
Contract Price ditto.
Magazine ditto.
Hospital Remains ditto.
Forage (daily) Issue ditto.
Forage Ration ditto.
Forage Receipt ditto.
Forage Balance ditto.
Forage Allowance Claims ditto.
Queries and Observations Register ditto.
Debit Vouchers Overdrawals ditto.
Debit Vouchers on Repayment ditto.
Sack Account ditto.
Ration Abstract ditto.
Guard Book, Stocktaking Reports.
" " Military Prison Accounts.
" " Divisional Orders.
Register of Letters.

Vouchers.

The issue and receipt vouchers in use in supply offices (field service) are chiefly as follows:—

Issues.

Daily Indent (Army Book 55). Sub-Voucher to A.F. 751
Daily Abstract of Issues. A.F. F. 751.
Way-Bills. A. Book 10.
Debit Vouchers. O. 1680.
Transfer, Conversion and Expenditure Voucher G. 1049
Delivery Voucher. G. 1033.
Issues on Repayment. P. 1958.
Bakery Statement. Monthly. F. 700.
Butchery Statement. Monthly. F. 708.

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Receipts.

Bakery Statement. Monthly. F. 700.
Butchery Statement. Monthly. F. 708.
Receipt Voucher. G. 1033.
Way-Bills. A. Book 10.
Transfer and Conversion Voucher. G. 1049.
Contractors' Bills. P. 1920.
„ „ HP. and M. P. P. 1931.

WEIGHTS, MEASURES, &c.

The following tables will be found to contain useful information as to weights and measures, both English and Foreign; coinage, of foreign countries, &c.

1. MISCELLANEOUS ENGLISH WEIGHTS AND MEASURES.

Measures of Length.

	In.	Ft.	Yds.	Pls.	Ch.	Fs.
Foot	12	1				
Yard	36	3	1			
Rod, pole, or perch ...	198	16½	5½	1		
Chain	792	66	22	4	1	
Furlong	7,920	660	220	40	10	
Mile	63,360	5,280	1,760	320	80	8

Particular Measures of Length.

A fathom 6 feet.
A cable's length 240 yards.
A degree 69⅛ miles = 60 nautical knots or geographical miles.
A league 3 miles.

Square or Surface Measure.

	In.	Ft.	Yds.	Pls.	Ch.	R.
Square foot ...	144	1				
Square yard ...	1,296	9	1			
Rod, pole or perch	39,204	272¼	30¼	1		
Square chain ...	627,264	4,356	484	16	1	
Rood	1,568,160	10,890	1,210	40	2½	1
Acre	6,272,640	43,560	4,840	160	10	4

A square mile contains 640 acres, = 2,560 roods, = 6,400 chains, = 102,400 rods, poles, or perches, = 3,097,600 square yards.

N.B.—The term square feet must not be confounded with feet square. A piece of cloth said to measure 6 square feet consists of 6 squares of a foot each, but a piece said to measure 6 feet square would be 6 feet along each side, and comprise 36 squares of a foot each. Square measure is computed by multiplying the length by the breadth.

Cubic or Solid Measure.

A cube is a solid body, and contains length, breadth, and thickness, having 6 equal sides. A cube number is produced by multiplying a number twice into itself, thus:—64 is a cube number, the cube of 4. 4 × 4 × 4 = 64.

1728 Cubic Inches	=	1 Cubic Foot.
27 Cubic Feet	=	1 Cubic Yard.
40 Do. of Rough, or 50 Do. of Hewn Timber	=	1 Ton or Load.
42 Cubic Feet of Timber	=	1 Shipping Ton.
108 Cubic Feet	=	1 Stack of Wood.
128 Cubic Feet	=	1 Cord of Wood.
40 Cubic Feet	=	1 Ton Shipping.
16 Cubic Feet Wood	=	1 "Fort" of Wood

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Liquid Measure.

	Gals.	Qts.	Pts.
Four Gills, 1 Pint	= ...	...	...
Quart	= ...	1 =	2
Gallon	= 1 =	4 =	8
Firkin or Quarter Barrel	= 9 =	36 =	72
Kilderkin or Half Barrel	= 18 =	72 =	144
Barrel	= 36 =	144 =	288
Hogshead of Ale (1½ Barrel)	= 54 =	216 =	432
Puncheon	= 72 =	288 =	576
Butt of Ale (3 Barrels)	= 108 =	432 =	864

Practically the only measures in use are gallons and quarts, the others are merely nominal; *e.g.*, the hogshead of 54 gallons, *old measure*, contains but 52 gallons, 1 quart, 1 pint, and 3·55 gills imperial measure, and of wine 6 nominal quart bottles go to the gallon.

Dry or Corn Measure.

4 Quarts	= 1 Gallon.
2 Gallons	= 1 Peck.
4 Pecks	= 1 Bushel.
3 Bushels (4 of Corn)...	= 1 Sack.
12 Sacks	= 1 Chaldron.
8 Bushels (or 2 Sacks)	= 1 Quarter.
5 Quarters	= 1 Load.

A Quarter of wheat measures, rough, 10 cubic feet.

Measures of Weight.

Avoirdupois Weight.

27⅓ Grains ...	= 1 Drachm = 27·34375	} Grains.
16 Drachms ...	= 1 Ounce = 437·5	
16 Ounces ...	= 1 Pound = 7000	
8 Pounds ...	= 1 Stone of Butcher's Meat.	
14 Pounds ...	= 1 Ordinary Stone.	
28 Pounds ...	= 1 Quarter (qr.).	
4 Quarters ...	= 1 Hundredweight (cwt.).	
20 Cwt. ...	= 1 Ton.	

This weight is used in almost all commercial transactions and common dealings.

Troy Weight.

24 grains	= 1 pennyweight.
20 pennyweights	= 1 ounce.
12 ounces	= 1 lb.

Stationery Table.

24 sheets of paper	= 1 quire.
20 quires	= 1 ream.
10 reams	= 1 bale.

Useful Weights and Measures. 1 sovereign = 2 drams.; 1 half-crown, 3½ drs.; 1 florin, 3 drs.; 1 shilling, 1½ drs.; 1 threepenny piece, ½ dr.; 1 tablespoonful holds 1 oz.; 1 dessert spoon, ½ oz.; 1 teaspoon, ¼. These measures are used for veterinary medicine.

Particular Weights.

A Stone, Horseman's weight	= 14 lbs.
A Firkin of Butter	= 56 ,,
A Firkin of Soft Soap	= 64 ,,
A Barrel of Raisins	= 112 ,,
A Barrel (or pack) of Soft Soap	= 256 ,,
A Fodder of Lead, London and Hull	= 90¼ cwt.
,, ,, Derby	= 22½ ,,
,, ,, Newcastle	= 21½ ,,
A Sack—Potatoes, 168 lbs.; Coals, 224 lbs.; Flour, 280 lbs.	
A Muid of Whole Mealies	= 196 ,,
,, crushed	= 200 ,,

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Of imported wines the following are the usual measurements:—

Pipe of Port or Masdeu	=	115 gallons.
,, Teneriffe...	=	100 ,,
,, Marsala	=	93 ,,
,, Madeira and Cape	=	92 ,,
Butt of Lisbon and Bucellas	=	117 ,,
,, Sherry and Tent	=	108 ,,
Aum of Hock and Rhenish	=	30 ,,
Hogshead of Claret	=	46 ,,

Hay and Straw.

Truss of Straw	=	36 lbs.
,, Old Hay	=	56 ,,
,, New Hay	=	60 ,,

Load, 36 Trusses = Straw, 11 cwt. 2 qrs. 8 lbs.; Old Hay, 18 cwt.; New Hay, 19 cwt. 1 qr. 4 lbs.

Bag of Coffee	=	1¼ to 1½ cwt.
,, Rice (East India)	=	about 1½ ,,
Bale of Coffee (Mocha)	=	2 to 2½ ,,
Barrel of Beef	=	200 lbs.
,, Butter	=	224 ,,
,, Gunpowder	=	100 ,,
,, Tar	=	26½ gallons.
Bushel of Coal	=	80 lbs.
Cask of Rice (American)	=	6 cwt.
Chaldron of Coal	=	36 bushels.
Chest of Tea (Congou)	=	about 84 lbs.
Gross	=	12 doz.
Hogshead of Sugar	=	13 to 16 cwt.
Loaf, quartern	=	4 lbs.
Tierce of Coffee	=	5 to 7 cwt.
,, Sugar	=	7 to 9 cwt.
Tub of Butter	=	84 lbs.

2. WEIGHT OF COAL, WOOD, &c.

Anthracite, per cubic yard solid	=	2,160 lbs.
Bituminous	=	2,025 ,,
Cannel	=	2,160 ,,
Coal, stored in the usual way...	=	1,400 ,,

Coal Storage.

In storing coal, 42 cubic feet of space per ton is required.

A cubic foot fresh water	=	62½ lbs.
,, salt water	=	63½ ,,
,, ash...	=	49 ,,
,, beech	=	43 ,,
,, birch	=	49 ,,
,, cork	=	15 ,,
,, elm	=	36 ,,
,, pine	=	41 ,,
,, oak	=	59 ,,
,, clay	=	125 ,,
,, loose earth	=	95 ,,
A cubic yard compressed hay	=	about 225 lbs.
,, hay in stack	=	about 126 ,,
,, compressed straw	=	about 145 ,,
,, straw in stack	=	about 90 ,,
,, of grain	=	about 20 bushels.

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3. FRENCH METRICAL SYSTEM OF WEIGHTS AND MEASURES.

THE Metrical System is based upon the length of the fourth part of a terrestrial meridian. The ten-millionth part of this arc was chosen as the unit of measures of length, and called a *Mètre*. The cube of the tenth part of the mètre was adopted as the unit of capacity, and denominated a *Litre*. The weight of a litre of distilled water at its greatest density was called a *Kilogramme*, of which the thousandth part, or *Gramme*, was adopted as the unit of weight. The multiples of these proceeding in decimal progression are distinguished by the employment of the prefixes *deca*, *hecto*, *kilo*, and *myria*, from the Greek, and the subdivisions by *deci*, *centi*, and *milli*, from the Latin:—

Measures of Length (unit Mètre).

EQUAL TO	Inches.	Feet.	Yards.	Fathoms.	Miles.
Millimètre	0·03937	0·003281	0·0010936	0·0005468	0·0000006
Centimètre	0·39371	0·032809	0·0109363	0·0054682	0·0000062
Décimètre	3·93708	0·328090	0·1093633	0·0546816	0·0000621
MÈTRE	39·37079	3·280899	1·0936331	0·5468165	0·0006214
Décamètre	393·70790	32·808992	10·9363306	5·4681653	0·0062138
Hectomètre	3937·07900	328·089917	109·3633056	54·6816528	0·0621382
Kilomètre	39370·79000	3280·899167	1093·6330556	546·8165278	0·6213824
Myriamètre	393707·90000	32808·991667	10936·3305556	5468·1652778	6·2138242

Cubic, or Measures of Capacity (unit Litre).

EQUAL TO	Cubic Inches.	Cubic Feet.	Pints.	Gallons.	Bushels.
Millilitre, or cubic centimètre	0·06103	0·000035	0·00176	0·0002201	0·0000275
Centilitre, 10 cubic do.	0·61027	0·000353	0·01761	0·0022010	0·0002751
Décilitre, 100 cubic do.	6·10271	0·003532	0·17608	0·0220097	0·0027512
LITRE, or cubic Décimètre	61·02705	0·035317	1·76077	0·2200967	0·0275121
Décalitre, or Centistère	610·27052	0·353166	17·60773	2·2009668	0·2751208
Hectolitre, or Décistère	6102·70515	3·531658	176·07734	22·0096677	2·7512085
Kilolitre, or Stère, or cubic mètre	61027·05152	35·316581	1760·97341	220·0966767	27·5120846
Myrialitre, or Décastère	610270·51519	353·165807	17607·73414	2200·9667675	275·1208459

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3. French Metrical System of Weights and Measures—*continued.*

Measures of Weight (unit Gramme).

Equal to	Grains.	Troy Oz.	Avoirdupois lb.	Cwt. = 112 lb.	Tons = 20 cwt.
Milligramme	0·01543 ...	0·000032 ...	0·0000022 ...	0·0000000 ...	0·0000000
Centigramme	0·15432 ...	0·000322 ...	0·0000220 ...	0·0000002 ...	0·0000000
Décigramme	1·54323 ...	0·003215 ...	0·0002205 ...	0·0000020 ...	0·0000001
Gramme	15·43235 ...	0·032151 ...	0·0022046 ...	0·0000197 ...	0·0000010
Décagramme	154·32349 ...	0·321507 ...	0·0220462 ...	0·0001968 ...	0·0000098
Hectogramme	1543·23488 ...	3·215073 ...	0·2204621 ...	0·0019684 ...	0·0000984
Kilogramme	15432·34880 ...	32·150727 ...	2·2046213 ...	0·0196841 ...	0·0009842
Myriagramme	154323·48800 ...	321·507267 ...	22·0462126 ...	0·1968412 ...	0·0098421

Square, or Measures of Surface (unit Are).

Equal to	Square Feet.	Square Yards.	Square Perches.	Square Roods.	Square Acres.
Centiare, or square mètre	10·464299 ...	1·196033 ...	0·0395383 ...	0·0009885 ...	0·0002471
Are, or 100 square mètres	1076·429934 ...	119·603326 ...	3·9538290 ...	0·0988457 ...	0·0247114
Hectare, or 10,000 square mètres	107642·993419 ...	11960·332602 ...	395·3828959 ...	9·8845724 ...	2·4718431

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4. TABLE FOR THE CONVERSION OF METRIC WEIGHTS AND MEASURES INTO ENGLISH.

Mètres into yards.		Kilomètres to miles and yards.			Litres into gallons and quarts.			Hectolitres into quarts and bushels.			Kilogrammes into cwts.	qrs.	lbs.	ozs.	Hectares into acres	r.	p.
1	1·094	1	0	1094	1	0	0·880	1	0	2·751	1	0	0	2	3¼	1	2	1	35
2	2·187	2	1	427	2	0	1·761	2	0	5·502	2	0	0	4	6½	2	4	3	31
3	3·281	3	1	1521	3	0	2·641	3	1	0·254	3	0	0	6	9¾	3	7	1	26
4	4·374	4	2	855	4	0	3·521	4	1	3·005	4	0	0	8	13	4	9	3	22
5	5·468	5	3	188	5	0	0·402	5	1	5·756	5	0	0	11	0¼	5	12	1	17
6	6·562	6	3	1282	6	1	1·282	6	2	0·507	6	0	0	13	3½	6	14	3	12
7	7·655	7	4	615	7	1	2·163	7	2	3·258	7	0	0	15	7	7	17	1	8
8	8·749	8	4	1709	8	1	3·043	8	2	6·010	8	0	0	17	10¼	8	19	3	3
9	9·843	9	5	1043	9	1	3·923	9	3	0·761	9	0	0	19	13¾	9	22	0	38
10	10·936	10	6	376	10	2	0·804	10	3	3·512	10	0	0	22	0¾	10	24	2	34
20	21·873	20	12	753	20	4	1·608	20	6	7·024	20	0	1	16	1½	20	49	1	28
30	32·809	30	18	1129	30	6	2·412	30	10	2·536	30	0	2	10	2¼	30	74	0	21
40	43·745	40	24	1805	40	8	3·215	40	13	6·048	40	0	3	4	3	40	98	3	15
50	54·682	50	31	122	50	11	0·019	50	17	1·560	50	0	3	26	3¾	50	123	2	9
60	65·618	60	37	498	60	13	0·823	60	20	5·072	60	1	0	20	4½	60	148	1	3
70	76·554	70	43	874	70	15	1·627	70	24	0·585	70	1	1	14	5¼	70	172	3	37
80	87·491	80	49	1251	80	17	2·431	80	27	4·097	80	1	2	8	6	80	197	2	38
90	98·427	90	55	1627	90	19	3·235	90	30	7·609	90	1	3	2	6¾	90	222	1	24
100	109·363	100	62	243	100	22	0·039	100	34	3·121	100	1	3	24	7	100	247	0	18
200	218·727	200	124	487	200	44	0·077	200	68	6·242	200	3	3	20	15	200	494	0	37
300	328·090	300	186	730	300	66	0·116	300	103	1·362	300	5	3	17	6	300	741	1	15
400	437·453	400	248	973	400	88	0·155	400	137	4·483	400	7	3	13	14	400	988	1	33
500	546·816	500	310	1217	500	110	0·193	500	171	7·604	500	9	3	10	5	500	1235	2	11

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5. FOREIGN MONEYS AND THEIR APPROXIMATE ENGLISH EQUIVALENTS.

Country.	Chief Coin.	Eng. Value. s.	d.
Argentine and Uruguay	Dollar	4	2
Austria and Hungary	Florin (silver)	1	11
Belgium	Franc	0	9½
Brazil	Milrei	2	1½
Canada and United States	Dollar	4	2
China	10 Mace = 1 Tael of Silver	6	0
Do.	Dollar (varies)	4	0
Cuba	Dollar	4	2
Denmark and Sweden	Kronor	1	1½
Egypt	Piastre	0	2½
Do.	50-Piastre Piece (gold)	10	2½
Do.	98-Piastres	20	0
France	Franc	0	9½
Germany	100-Pfennige = 1 Mark	1	0
Do.	20-Mark (gold)	19	7
Greece	Drachma (100 lepta)	0	9½
Holland and Java	Florin	1	8
Do.	10-Florin (gold)	16	8
India	Rupee (about)	1	9
Do.	Mohur, 15 do. (gold)	9	2
Italy	Lira	0	9½
Japan	100-Sen = 1 Yen	4	1½
Do.	10-Yen Piece (gold)	41	0
Mexico, Chili, Peru	Dollar (about)	4	2
Persia	Toman	10	6
Portugal	Milrei (about)	4	10
Russia	Silver Rouble (paper 2/6)	3	0
Spain	100 Centimes = 1 Peseta	0	9½
Sweden and Norway	100 öre = 1 Kroner; 18 Kroner	20	0
Switzerland	Franc	0	9½
Turkey	40 Paras = 1 Piastre (nearly)	0	2¼
Do.	100 Piastres = £ Turkish	18	0
West Indies*	Dollar	4	2

In Egyptian Currency, the piastre of 40 paras (average rate of exchange) = $2\frac{1}{2}d.$

The kees, or purse, of 500 piastres (average rate of exchange = £5 2*s.* 6*d.*).

Piastres are of two values "tariff" and "current."

The tariff value is the standard one, and is used in all government offices, by bankers in their accounts, and in the list of fares for railways and telegraphs.

The current value is used in all the petty commerce of Egypt, and in the market and bazaars; but there is no paper money to represent it, and the same coin is used for a piastre "tariff" and a piastre "current."

As a general rule, the piastre current is half the value of the piastre tariff, so that the two silver Egyptian pieces most commonly met with represent respectively $\frac{1}{2}$ a piastre tariff and 1 piastre tariff, or 1 piastre current and 2 piastres current; there is but one coin to represent the two values.

* In these, as in all British Colonial Possessions, English money is current of every denomination.

In the above table the equivalent values are given as near as possible, but generally foreign moneys are not exactly commensurate with English, as the course of exchange continually varies, affecting consequently the relative values.

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Egyptian Weights and Measures.

The most useful weights are:—

The rotl	= about 1 lb. avoirdupois.		
,, oke	= ,, 2¾ lbs. ,,		
,, kantar	= ,, 98 lbs. ,,		
4 kumh (grains)	make 1 kirât or kharûbeh.		
16 kirât	,, ,, 1 dirhm (drachm).	}	These probably vary according to the locality.
12 dirhm	,, ,, 1 wukîyeh (araboz).		
12 wukîyeh	,, ,, 1 rotl.		
400 dirhm	,, ,, 10 keor wakka.		
100 rotl	,, ,, 1 kantar		

In English avoirdupois weight:—

1 rotl = about 1 lb.
1 wukîyeh = ,, 21 drachms (or about 1¼ oz.).
1 dirhm = ,, 1¼ ,,

Corn Measures.

In Lower Egypt:—

9 kuddah make 1 melweh.
4 ,, ,, 1 rûba.
2 rûba ,, 1 kayleh.
2 kayleh ,, 1 waybeh.
6 waybeh ,, 1 ardeb = 5⅔ bushels.

In Upper Egypt:—

4 rofton make 1 mid.
3 rûba ,, 1 ,,
8 mid or waybeh make 1 ardeb or 5⅔ English bushels.

The ardeb is used as a measure of tonnage for boats, 7½ ardebs = 1 ton.

Tonnage.

The method of reckoning a vessel's tonnage, carpenter's measurement, is as follows: for a single deck vessel, multiply the length of keel, the breadth of beam, and depth of hold together, and divide by 95. For a double deck vessel, multiply as before, taking half the breadth of beam for the depth of the hold, and divide by 95.

6. EXTRACTS FROM WEIGHTS AND MEASURES ACT, SECTIONS 15, 16, AND 17.

15. The unit or standard measure of capacity, from which all other measures of capacity, as well for liquids, as for dry goods, shall be derived, shall be the gallon containing ten imperial standard pounds weight of distilled water weighed in air against brass weights, the water and the air being at a temperature of 62 degrees of Fahrenheit, the barometer being at 30 inches.

A gallon contains 277·2739 cubic inches. A cubic foot of water, under these conditions, weighs 997·136969 oz.

The quart shall be one-fourth part, and the pint shall be one-eighth part of the gallon.

Two gallons shall be a peck, and eight gallons shall be a bushel, eight such bushels shall be a quarter, and thirty-six such bushels shall be a chaldron.

16. A bushel* for the sale of any of the following articles, viz.: lime, fish, potatoes, fruit, or any other goods

* The Imperial bushel measure is 18 inches in diameter and 9 inches in height, internal measure.

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and things, which, before passing of "The Weights and Measures Act, 1835," that is to say, the 9th day of September, 1835, were commonly sold by heaped measure, shall be a hollow cylinder having a plane base, the internal diameter of which shall be double the internal depth, and every measure used for the sale of any of the above-mentioned articles which is a multiple of a bushel, or is a half-bushel, or a peck, shall be made of the same shape and proportion as the above-mentioned bushel.

17. In using an imperial measure of capacity, the same shall not be heaped, but either shall be stricken with a *round* stick or roller, straight, and of the same diameter from end to end, or, if the article sold cannot, from its size or shape, be conveniently stricken, shall be filled in all parts as nearly to the level of the brim as the size and shape of the article will admit.

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LIST OF APPENDICES.

APPENDIX.	SUBJECT.
I.	A.F.P. 1920. To shew system of making out a bill for a purchase in default of a Contractor.
II.	A.F.P. 1920. To shew system of charging the Contractor for the extra expense incurred by his default.
III.	A.F.O. 1680. Debit voucher made out to give Contractor credit for a sale on his behalf in connection with purchase in Appendix I.
IV.	A.F.P. 1920. To shew manner of making out a bill for a special purchase not under Contract.
V.	A.F.P. 1920. To shew manner of making out a bill for an ordinary service performed under Contract.
VI.	List of approximate quantities of materials used with 1,000 lbs. of flour in making bread.
VII.	A.F.F. 700. Bakery account (Garrison and Field).
VIII.	A.F.F. 708. Butchery account (Field Service only).
IX.	A.F.O. 1680. Debit voucher made out as for recovery of value of supplies lost on service.
X.	A.F.O. 1680. Debit voucher made out as for recovery of value of rations overdrawn.
XI.	Statement shewing ordinary method of arriving at value of a ration of bread and meat where there is an Army Bakery and Abattoir.
XII.	Form of voucher for striking off a minor deficiency in supplies when a Board is not assembled.
XIII.	Form of issue voucher for a special issue by order of General Officer Commanding.
XIV.	Form of issue voucher for striking off supplies abandoned on Service.
XV.	Form of voucher for supplies issued on repayment.
XVI.	Paymaster's receipt for rations to be issued on repayment on Field Service.
XVII.	List of Field Service supply packages.
XVIII.	Form of agreement for engaging Civilian Conductors, Labourers, &c.

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Pro Formâ. *Purchase in Default.*

APPENDIX I.

Army Form P. 1920,

(On Account of the Public Service.)

ACCOUNT of supplies furnished by Messrs. Masterson Bros., of Guildford, during the month of September, 1890 :—

Station.	Description of Articles.	Price.	Amount. £	s.	d.
		Per head.			
Woolmer ..	10 head of cattle (bullocks)	£18	180	0	0
	Deduct excess cost of this purchase in default from Messrs. Schofield's account for meat for September, 1890, i.e., dead meat from 10 cattle, 6,500 lbs. ..	—	*180*	*0*	*0*
	i.e., contract price of 6,500 lbs. of meat at 6d.	—	*162*	*10*	*0*
	Less sale of 10 hides at 10s. each	—	*17* *5*	*10* *0*	*0* *0*
	To be paid by meat contractor	—	*12*	*10*	*0*
Amount in words— One hundred and Eighty pounds.			£180	0	0

Signature of Contractor (Signed) MASTERSON BROS.
Dated 1st October, 1890.

Certified that the above supplies have been delivered, and will be credited in my Provision Store account for the month of September, 1890.

Signature of Officer in charge of Supplies.
(Signed) JAMES JONES, Major A.S.C.
Station—Woolmer. Date—3rd October, 1890.

N.B.—At the expiration of each month the Contractor should transmit to the Officer in charge of Supplies, an account, on this form, of the supplies delivered within the month. It is essential that the full Christian name, Surname, and address of the Contractor, be given in the space provided above for that purpose.

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Appendix II.

Army Form P. 1920

(On Account of the Public Service.)

ACCOUNT of supplies furnished by Messrs. Schofield & Sons, of Guildford, during the month of September, 1890. Contract $\frac{7796}{4370}$, W.O. 6.6.'90 :—

Station.	Description of Articles.	Price.	Amount. £	s.	d.
Woolmer ..	Supply of 52,000 lbs. meat	6*d.* per lb.	1,300	0	0
	Vide Messrs. Masterson Bros. account for September for 10 head of cattle purchased in default—				
	Deducting sale of hides	—	*175*	*0*	*0*
	Produce of 10 head of cattle = 6,500 lbs.				
	Contract cost of 6,500 lbs. of meat	—	*162*	*10*	*0*
	To be deducted from this account	—	*12*	*10*	*0*
Amount in words— Twelve hundred and Eighty-seven pounds Ten shillings.		£	1,287	10	0

Signature of Contractor—SCHOFIELD & SONS.
Dated 1st October, 1890.

Certified that the above supplies have been delivered in accordance with the terms of Contract, and will be credited in my Provision Store account for the month of September, 1890.

Signature of Officer in charge of Supplies.
(Signed) JAMES JONES, Major A.S.C.
Station—Woolmer. Date—3rd October, 1890.

N.B.—At the expiration of each month the Contractor should transmit to the Officer in charge of Supplies, an account, on this form, of the supplies delivered within the month. It is essential that the full Christian name, Surname, and address of the Contractor, be given in the space provided above for that purpose.

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Appendix III.

Army Form O. 1680.

Debit Voucher No.

Army Service Corps,
Woolmer Camp,
11th Sept., 1890

To be received by the District Paymaster at Aldershot the sum of Five pounds (£5) from Mr. James Denny of Frencham, being the value of 10 hides of cattle purchased in default of Contractor for Meat.

Vide Messrs. Masterson's and Messrs. Schofield's Accounts for Cattle and Meat respectively for Sept., 1890.

(Signed) JAMES JONES,
Major A.S.C.

Credited in my Account for Oct., 1890.

(Signed) G. BRADY, Major,
for District Paymaster

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Appendix IV.

Army Form P. 1920.

(On Account of the Public Service.)

ACCOUNT of supplies furnished by Matthew George, of 5, Stoke Road, Gosport, during the month of July, 1891 :—

Date of last purchase, August, 1890, at same rate.

Station.	Description of Articles.	Price.	Amount. £	s.	d.
Gosport ..	6,720 lbs. of fuel wood Required for R.A. encampment near Fort Rowner .. .. Payment approved—included in Schedule of Special Purchases—Southern District for August, 1891 .. (Sd.) SAMUEL WHYTE, Col., A.A.G., for Lt.-Genl. Commanding S. Dist. *Portsmouth*, 7.8.91.	Per ton. 26*s.*	3	18	0
Amount in words— Three pounds, eighteen shillings.			£3	18	0

Signature of Contractor—MATTHEW GEORGE.

Dated 1st August, 1891.

Certified that the above supplies have been delivered, and that the price is fair and reasonable and lowest obtainable, and will be credited in my account for the month of July, 1891.

Signature of Officer in charge,

(Signed) JAMES GRUNDY, Major A.S.C.

Station—Gosport. Date—2nd August, 1891,

N.B.—At the expiration of each month the Contractor should transmit to the Officer in charge of Supplies, an account, on this form, of the supplies delivered within the month. It is essential that the full Christian name, Surname and address of the Contractor, be given in the space provided above for that purpose.

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Appendix V.[1]

Army Form P. 1920.

(On Account of the Public Service.)

ACCOUNT of supplies furnished by Carrington Brothers, of Mark Lane, London, E.C., during the month of July, 1891. Contract $\frac{7693}{4796}$, W.O. 6.4.91.

Station.	Description of Articles.	Price.	Amount. £	s.	d.
Aldershot ..	500 quarters of oats 160,000 lbs.	Per qrtr. of 320 lbs. 17*s.*	425	0	0
Amount in words— Four hundred and Twenty-five pounds.			£425	0	0

Signature of Contractor—CARRINGTON, BROS.
Dated 1st August, 1891.

Certified that the above supplies have been delivered in accordance with the terms of Contract, and will be credited in my account for the month of July, 1891.

Signature of Officer in charge,

(Signed) J. A. W. ARIS, Major, A.S.C.

Station—Aldershot. Date—2nd August, 1891.

N.B.—At the expiration of each month the Contractor should transmit to the Officer in charge of Supplies, an account, on this form, of the supplies delivered within the month. It is essential that the full Christian name, Surname, and address of the Contractor, be given in the space provided above for that purpose.

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Appendix VI.

List of approximate quantities of Materials to be expended with 1,000 lbs. of Flour in the production of Bread.

For Long Sponges.

Malt	....	....	....	....	3 lbs.
Hops	....	....	....	....	2 oz.
Sugar	....	....	....	....	3 oz.
Cones	....	....	....	....	14 lbs.
Salt	....	....	....	....	11 lbs.

For Short Sponges.

Malt	....	....	....	....	1½ lbs.
Hops	....	....	....	....	1 oz.
Sugar	....	....	....	....	2 oz.
Cones	....	....	....	....	14 lbs.
Salt	....	....	....	....	11 lbs.

Wood for Aldershot Oven, 1st heating .... 300 lbs.
Ditto, 2nd and subsequent heatings .... 100 lbs.

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HOME AND ABROAD.

Appendix VII.

_____ STATION.

BAKERY ACCOUNT for _____ 189 . Army Form F. 700.

To be transmitted to the Officer in charge of Supplies of the Sub-District or Command by the 3rd day of the month following that to which it has reference.

	Flour.			Bread.		Hops	Malt	Potatoes	Salt	Yeast powder	Coal	Coke	Wood	Candles	Oil		
	Hospital lbs.	Ration lbs.	Cones lbs.	Hospital lbs.	Ration lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	ts.		
Remain from last account																	
Received from Mr.																	
,, ,, ,, ...																	
,, ,, ,, ...																	
read produced from flour expended below																	
TOTAL RECEIPTS ...																	
Expended in the production of bread ...																	
Issued to the Troops as rations*																	
Damaged bread sold																	
Flour sweepings sold																	
Issued to Hospital																	
,, on repayment...																	
TOTAL ISSUES ...																	
Remaining on hand																	

_____ lbs. bread produced, representing a gain of _____ per cent. on the flour used.
_____ lbs. flour sweepings sold, being _____ per cent. on the flour used.
_____ lbs. damaged bread sold, being _____ per cent. on the bread produced.

I Certify that, to the best of my belief, the above return is correct in all respects.

The balance remaining was last verified by _____ on the _____ day of _____ 189 . _____ *In charge of Bakery.*

I hereby certify that the above account has been examined by me, and that the total quantity of bread shown as issued to the Troops as rations has been carried into my Monthly Abstract of Provisions, Army Form F. 775 (or F. 753).

Date _____

_____ Name } *Officer in charge*
_____ Rank } *of Supplies.*

Forms
F. 700
9

* The Corps' receipts will be retained by the Officer in charge of Supplies.

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For Active Service only—

Forms F. 708 2

Army Form F. 708.

Appendix VIII.

_____ STATION.

BUTCHERY ACCOUNT.

FOR THE MONTH OF

_____ 189

(To be transmitted with the Supply Accounts.)

LIVE CATTLE.

	Bullocks. No.	Sheep. No.
Remain from last account		
Received from Mr.		
TOTAL RECEIPTS.		
Slaughtered, producing dead meat, as below		
TOTAL ISSUES.		
Remaining on hand		

DEAD MEAT.

	Beef. lbs.	Mutton. lbs.
Remain from last account		
Produced from Cattle shown above as slaughtered		
TOTAL RECEIPTS.		
Issued to the Troops as rations*		
,, on repayment		
,,		
TOTAL ISSUES.		
Remaining on hand		

I Certify that to the best of my belief the above account is correct in all respects.

_____ *In charge of Butchery.*

The balance remaining was last verified by _____ on the _____ day of _____ 189_____

I hereby certify that the above account has been examined by me, and that the total quantity of Meat *shown as issued to the Troops as rations* has been carried into my Monthly Abstract of Provisions, Army Form F. 753.

_____

Officer in Charge of Supplies.

Date _____

* The Corps' receipts will be retained by the Officer in charge of Supplies.

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Appendix IX.

Army Form O. 1680.

Debit Voucher No.

Army Service Corps,
Woolmer,
1st Oct., 1890.

To be received by the District Paymaster at Aldershot, the sum of 15*s.* (Fifteen Shillings) from Officer Commanding 17th Lancers, Aldershot, being the value of 20 Corn Sacks not returned to A.S.C. Stores at termination of Cavalry Manœuvres.

(Signed) JAMES JONES,
Major A.S.C.
in charge of Supplies.

Credited in my Account for Oct., 1890.

(Signed) G. BRADY, Major,
for District Paymaster.

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Appendix X.

Army Form O. 1690.

Debit Voucher, No.

Encampment, Woolmer,
1st Oct., 1890.

To be received by the District Paymaster at Aldershot, the sum of Two Pounds Nineteen Shillings and Threepence from Officer Commanding 11th Hussars, Aldershot being the value of 93 Rations of Bread and Meat overdrawn during September, 1890, at Woolmer.

93 Rations at 7·646*d.* = £2 19*s.* 3·078*d.*

(Signed) JAMES JONES,
Major A.S.C.
In charge of Supplies.

Credited in my Account for Oct., 1890.

(Signed G. BRADY,
Major A.S.C.

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Appendix XI.

To arrive at the cost of a ration of Bread, the following items should be taken according to current prices :—

	£	s.	d.
Flour, per sack....	1	3	3
Cost of articles used in manufacture	0	0	11·20
Wear and tear of implements	0	0	0·25
Pay and Corps pay	0	2	11·28
Transport	0	0	4·40
	£1	7	6·13

Assume that a sack of flour (280 lbs.) will produce 368 lbs. of bread.

$$\frac{£\ 1\ 7\ 6{\cdot}13}{368} = {\cdot}896 = \text{cost of 1 lb. bread.}$$

Meat—Under canvas the ration is 1 lb.

	d.
Contract price per lb.	6·74
Add for expenses, per lb.....	·01
	6·75

	d.
Cost of 1 lb. bread	·896
„ meat....	6·75
Cost of a Ration under canvas, exclusive of ½ lb. bread issued with Grocery Ration.	7·646

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Appendix XII.

Supply Account, A.S.C

Issue Voucher, No. 46.

Kassassin,
Sept., 1882.

Certified that the following quantities of Supplies have become deficient from the causes stated, viz. :—

10 gallons of rum, owing to leakage of barrel.

62 lbs. of sugar. Actual loss in weight of Reserve Stock on hand, through supply becoming dry from effects of Climate.

The above were not caused by neglect; the deficiencies were quite unavoidable. The barrel of rum had been much knocked about in transit during the Campaign.

(Signed) T. JOHNSON,
Major A.S.C.,
Supply Officer.

Kassassin,
30th September, 1882.

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Appendix XIII

Supply Account.

Issue Voucher, No. 63.

Tel-el-Mahuta,
August, 1882.

The Officer in Charge of Supplies, Tel-el-Mahuta.

Please issue the following supplies to Mustah Fendi, employed as a spy by G.O.C. Division :—

1 bottle of brandy.
2 lbs. meat.
2 lbs. bread.
2 days' grocery rations.

(Signed) J. BURBERRY,
Colonel A.G.B.

30th August, 1882.

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Appendix XIV.

Issue Voucher.

Supply Account, Sept., 1890.

Assistant-Adjutant General (*b*)
3rd Division.

I beg to forward attached list of supplies abandoned yesterday owing to the unexpected advance of the enemy. After the repulse of the enemy's forces, I sent a party with transport to bring the supplies (which had been left at former depôt) here. This party found that the supplies had been captured. Under the circumstances I beg to request that a Board of Officers may assemble to report on this loss.

(Signed) G. Braham,
Capt. A.S.C.,
In Charge of Supplies.

Johannesburg,
3rd September, 1890.

No Officers available for a Board. I am aware of the loss of these supplies. Loss unavoidable. Strike off charge and support by this authority.

(Signed) G. Blunt,
Major-General.

3rd September, 1890.

List of supplies captured by the enemy, 2nd September, 1890 :—

Rum	barrels	2
Port wine	cases	5
Tea	lbs.	200
Sugar	„	400
Coffee	„	300
Preserved meat	„	500
Biscuit	„	373

(Signed) G. Braham,
Capt. A.S.C.,
In Charge of Supplies.

Johannesburg,
3rd September, 1890.

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APPENDIX XV.

ISSUE VOUCHER, No. .

Required by the Regiment, the undermentioned Supplies on repayment :—

lbs. Soap at per lb. .. .. £

lbs. Tobacco at per lb. .. .. £

Total .. £

Officer Commanding

Date

The above amount of £ will be found credited to the public on Voucher No. of my Cash Accounts at for the month of

Paymaster

RECEIVED the above-named Supplies.

Quartermaster

Regiment

Date

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Appendix XVI.

Certificate for Rations issued on Repayment.

CERTIFIED that the amount of £ has been received from
being the value of rations of provisions, and
rations of forage required to be drawn by him daily between the day of and the day of , both days inclusive, and that this sum will be found credited on Debit Voucher No. of my Cash Accounts for the month of .

Paymaster at

Date

RATIONS have been issued by me as follows on the dates respectively named.

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APPENDIX XVII.

LIST showing the patterns of existing packages in which Army Service Corps supplies are packed for Field Service.

Articles.	Description of Package.	Weight.		Cubical Measurement.	Remarks.
		Gross lbs.	Net lbs.	ft. in.	
Ale ... ... 24 pint bottles	Case	84	—	1 9	
Arrowroot ... ... 5 tins	,,	73	50	1 10	
Barley ... ... 5 tins	,,	73	50	1 10	
Biscuit ... ... tin-lined	,,	86	60	3 0	
Do.	Bag	83	80	5 0	
Brandy ... ... 12 bottles	Case	63	—	2 3	
Candles, stearine	,,	79	60	2 5	
Do. magazine	,,	80	60	2 11	
Cheese	Drum	68	62	1 8	Average.
Cocoa and milk ... ... 60 tins	Case	80	60	1 10	
Coffee ... ... 5 tins	,,	81	50	2 9	
Chicken, boiled ... ... 48 tins	,,	79	48	2 0	
Champagne ... ... 18 ½-bottles	,,	69	—	2 3	
Extractum carnis ... ... 180 4-oz. tins	,,	79	45	1 9	
Flour	Bag	82	80	1 9	Liable to variation.
Forage—					
Hay, compressed	Bale	83	80	4 4	Average.
Forage, cake	,,	82	80	1 8	Do.
Oats	Sack	82	80	2 9	
Hops ... ... tin-lined	Case	46	20	3 1	
Limejuice ... ... 3 jars	Case	80	30	3 1	
Malt ... ... tin-lined	,,	80	56	2 7	
Meat biscuit ... ... 54 tins	,,	78	40½	2 11	
Meat, preserved	,,	83 to 85	57	1 11	
Medical comforts ... ... pannier	Wicker pannier	84	—	3 5	Average.
Containing—					
Tea ... ... 2 lbs.	Intin				
Sugar ... ... 6 ,,	,,				
Brandy ... ... 8 bottles					
Extract of meat ... ... 6 lbs.	In 4 oz. tins				
Solidified soup ... ... 4 ,,					

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Appendix XVII.—*continued.*

Articles.	Description of package.	Weight. Gross lbs.	Weight. Net lbs.	Cubical Measurement. ft.	Cubical Measurement. in.	Remarks.
Arrowroot ... ... 1½ lbs.	In tin					
Mustard ... ... ½ ,,	,,					
Pepper ... ... ½ ,,	,,					
Salt .. .. 1 ,,	ditto, lined with wood					
Candles ... ... 2 ,,	In tin					
Soap ... ... 1¼ ,,						
Castors, pepper, pewter ... ... No.	1					
Corkscrews ... ... ,,	1					
Corks, carving ... ... ,,	1					
Knives { Carving ... ... ,, / Opening meat tins ... . ,,	1 / 4					
Measures, block tin ... ... nests of	1					
Pots, pewter, mustard ... ... No.	1					
Salt-cellars, wood ... ... ,,	1					
Milk, condensed ... ... 60 tins	Case	80	60	1	10	
Oatmeal ... ... 5 tins	,,	73	50	1	10	
Oil, colza ... ... 6 gallons	Iron drum	64	54	1	6	
Pepper ... ... 10 tins	Case	78	50	2	3	
Port wine ... ... 12 bottles	,,	65	—	2	3	
Porter ... ... 24 pint bottles	,,	84	--	1	9	
Potatoes, preserved	,,	72	50	2	3	
Rice ... ... 5 tins	,,	73	50	1	10	
Rum	Small cask	119	—	3	6	
Sago ... ... 5 tins	Case	73	50	1	10	
Salt	Double bag	83	80	1	9	
Soap ... ... 24 bars	Case	about 85	about 72	—		Supplied from Pimlico.
Soups ... ... 48 tins	,,	79	48	2	0	
Sugar	Double bag	83	80	1	11	
Tea ... ... 3 tins	Case	78	48	3	3	
Tobacco ... ... repacked	,,	80	60	1	8	
Do. ... ... original package	,,	145	120	2	3	
Vegetables, compressed ... ... { 4 tins of 10 lbs. / 3 ,, 5 ,,	,,	79	55	1	11	
Whiskey ... ... 12 bottles	,,	63	—	2	3	
Yeast powder ... ... 9 tins	,,	84	54	2	9	

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Appendix XVIII.

Army Form F 767.

I,

Hereby agree to serve in the Army Service Corps as a or on such other duties as I may be ordered to perform at the rate of per diem, for months, or such less period as my services may be required.

If my services are dispensed with on reduction of Establishment, before the expiration of the months, one month's notice or one month's pay to be given to me.

In case of my dismissal from inefficiency or misconduct the month's notice to be dispensed with, and pay only issued to date of my dismissal. One month's notice to be given by me in case I wish to resign my appointment after months.

Should I have to perform mounted duties, the Army Service Corps to provide me with a Horse and Forage, also Rations of supplies for myself whenever employed in the Field.

Place

Employed from this date

Witness.

A.A.G.

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